Market Nursery Work Series

VOL. I.

GLASSHOUSES AND THE PROPAGATION OF PLANTS

F. J. FLETCHER, F.R.H.S.

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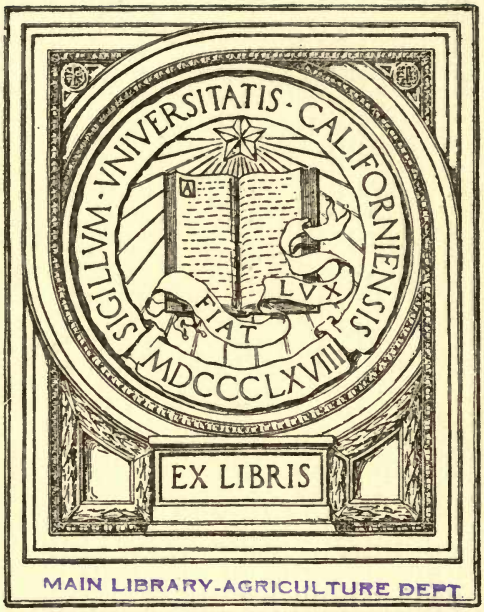

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MARKET NURSERY WORK

MARKET NURSERY WORK

A SERIES OF SIX BOOKS
ON THE CULTIVATION
OF CROPS FOR MARKET

BY
F. J. FLETCHER, F.R.H.S.

VOLUME I.

GLASSHOUSES AND THE PROPAGATION OF PLANTS

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PREFACE

In sitting down to write this work, the writer feels like one who, having made a long pilgrimage, looks back along the road, milestone beyond milestone, and from the recesses of his memory and varied experiences, calls up again those things through which he has passed, and to which through the greater part of his life he has accustomed himself. This initial volume is intended to lead the way to others of a more advanced character, and is such as, in the long past, the writer would have been glad to use had such a work existed. When he first set out on his career as nursery boy the guns of '71 were hurling defiance and destruction between the armies of France and Germany, and one cannot help recalling that fact now that the long-expected results of the conflict have worked out to their conclusion; but it has seemed a long time, and during all those years the author has been constantly engaged in the propagation and cultivation of plants. He now offers the fruits of his personal experience, not to others of his own age, but to the younger and more inexperienced with whom lies the future of British nursery work, in the hope that the knowledge which he has acquired during a lifetime, combined with the optimism and enthusiasm which are characteristic of younger men, will produce a worthy result.

The second volume of this little work will deal with special glasshouse crop plants, the third with roses, the fourth with carnations, the fifth with orchard fruit-tree culture, and the last with decorative plants, trees and shrubs.

F. J. FLETCHER.

September, 1921.

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MARKET NURSERY WORK

INTRODUCTION

THE NURSERYMAN

Among those who are prone to generalise rather than to reason there is a widely prevailing idea that the principal difference between a nurseryman and a private gardener is one of "rough and ready" methods as distinct from those of a careful and even a fastidious character. Nothing could well be wider of the mark, and our first step must be to dissipate that fallacy and impress upon all who read these lines the fact that the great nursery establishments of our land are not only *not* built up on any but precise and scientific methods, but that any attempt to run them on "rough and ready" lines would most indubitably bring about their undignified appearance in the Bankruptcy Court.

The really fundamental difference between the gardener and the nurseryman is purely economic. It is quite safe to say that prior to 1914 the private gardener, in his laudable anxiety to produce things as nearly perfect as possible, could pursue all necessary operations without being too violently brought into contact with the question of cost, and though he finds his liberty somewhat curtailed in the present days, this still holds good to a certain extent. At the worst, he has only to clear expenses; he is not expected to show a profit. The nurseryman, on the contrary, while turning out products of equal perfection, has to do so with a strict regard to costs, and these must, under no circumstances, exceed that point at which current market selling prices permit him to show a reasonable margin of profit. To the one, then, the cost of production is, to say the least, a subsidiary matter; to the other, it is absolutely vital—a distinction *with* a very appreciable difference.

It is well that everyone who aspires to be either a nurseryman or a responsible nursery employee should appreciate the fact that, primarily, he must grow for profit and not for pleasure.

Another distinctive feature is that of " Quantities." Where the private gardener thinks in terms of dozens and hundreds, the nurseryman thinks in terms of thousands—the gardener knows the limits of his requirements, the nurseryman is ever striving to expand his limits, and his products must keep pace with his expansion. The mind of each habituates itself to the position—one within defined limits, the other enormously elastic.

This matter of expanding quantities, very often without expanding accommodation, has caused many nurserymen to specialise along certain lines, and it is to this development that we owe the almost flawless perfection to be seen in the leading lines poured into Covent Garden and other markets. By preference, or tradition, a nurseryman is keenly interested in certain lines more than in others. He is successful with them because he has a special knowledge of them. He knows to a nicety to what conditions they will best respond, and he knows, too, that if they are up to standard there is a large demand for them. So he lays himself out to supply those conditions by a scientific arrangement of his nurseries on correct lines, and also by the training and employment of highly specialised labour. He builds his greenhouses lofty or low, as circumstances dictate; he instals a heating apparatus of the needed capacity, whether for four, six, or eight rows of 4-inch piping; provides the best method of ventilation according to requirements, and, in short, leaving nothing to chance, relies upon the smooth working of well-thought-out designs to turn out his produce as regularly and methodically as cotton goods are turned out from the factories.

Such specialisation is far from general, and chiefly occurs in " market " nurseries. By far the greater number of nurseries grow for a more general trade—local, county or even national. They are expected to supply anything from a Double Daisy to an Orchid, from a Quickthorn to a Wellingtonia, from a Strawberry Runner to a finely trained Peach Tree. The best of these nurseries are run in departments, not only for the sake of convenience, but as a modified form of specialisation, and for the more economical and profitable use of specialised labour.

For example, the skilled hand who has spent many years in the scientific building up of young fruit trees is likely to know but little, and to care even less, about the propagation of Lobelias, Begonias and other bedding plants; and a "hand" whose greatest joy in life is the Rose (and there are many such men), who is a great enthusiast, and successful *because* he is an enthusiast, is not likely to interest himself very deeply in Cacti and Orchids. A wise nurseryman, knowing these proclivities, avails himself of all the enthusiasm belonging to them, and thereby secures the services of hearts, as well as those of brain and brawn.

CHAPTER I.

GREENHOUSES

As the heart is to the body, so, in a very real sense, is glass to the nursery. Take this statement literally, think out all that it means, and you will come to appreciate its truth.

Hothouses are designed to produce artificially conditions approximating to those under which plants of alien origin grow in their native habitats under tropical skies. *Unheated greenhouses* are designed to counteract the vagaries of our English climate, to conserve the heat given by the sun, to exclude cold winds and generally to promote genial conditions.

Hothouses range from the "Stove," with its minimum temperature of 60° to 65°, in which tropical plants are cultivated, to the "temperate" house, with its minimum of 45°, where the native plants of more temperate zones find a home. In the former houses very special provision is made for heat combined with moisture, the two elements essential to the plants there grown; but the less exacting plants of the temperate house need the same elements, though in a modified degree. The degree of skill and judgment brought to bear upon the supply of these, combined with ventilation, will prove whether the management of the houses is efficient or otherwise.

While a close and careful study of the habits and needs of plants generally is the best guide to their successful cultivation

there are certain fundamental principles in the management of greenhouses that must not be overlooked. They are, in character, hygienic. Whether the houses be heated or unheated, the ideal must be to maintain an equable temperature, and the variations, as indicated by the thermometer, should be as little as possible. In the former, the heating apparatus is the all-important factor; in the latter, the ventilating gear has to be relied upon.

Heating Apparatus

With the various types of boilers we are not here concerned save to point out that, because of their vital importance, the most efficient cannot be too good. There is no great difference in principle between any of the standard makes, and their efficiency and effective capacity is determined very much by the degree of intelligence with which they are attended to.

We have pointed out the need for maintaining an equable temperature in the houses, and, apart from sun-heat, the only other means of supplying warmth is the hot-water system. Seeing how much is really at stake, how important it becomes that the care of the boiler should be in careful, experienced, intelligent hands! The stoker should attend to his duties regularly, systematically, methodically; with his eye on the thermometer. The flues should be carefully cleaned every morning, the damper kept in smooth working order, and the chimney free from soot. We have, in our experience, seen disaster follow disaster when the stoking was left to boys or to incompetent men who attend to their duties spasmodically, sometimes making the hot-water pipes too hot to lay the hand upon, and at others allowing them to be dead cold. Stoking ought to be learnt; it is no job for the novice.

Ventilation

In glasshouse construction the provision of the means of ventilation should be scientific and practical. Not only must there be top ventilation, but bottom ventilation is equally

important if the desideratum be a free circulation of air without cold draught. Many practical men agree that the ordinary leverage system, as applied to thousands of greenhouses, is not a perfect system, whatever may be said for it as a labour-saving appliance. In practice it too often means that you must open all or none, and there are often occasions where, in a hothouse, one open ventilator in the centre is all that is necessary. Top vents without inferior lower vents are unsound. They are the natural outlets for the hot air, but not for the admission of fresh air. It is the nature of hot air to rise; the hottest part of the house is up in its apex. The admission of fresh air must be provided for low down in the structure, the most convenient place being in the sustaining walls. With quite small vents there, the ingress of air can be controlled, and it then mingles with and helps to circulate the warmer atmosphere, in Nature's own approved way.

The handling of ventilators is very important, and, as a rule, it is always done, as it should be done, under the direction of the foreman or some other responsible hand. Imagine for a moment that it is April. A cold north-easter is blowing outside, which penetrates to the marrow even though the sun is brilliantly shining. The hothouse is crowded with thousands of seedlings, delicate and fragile as a gossamer. The sun runs the temperature up to an abnormal and unhealthy height, and there remains nothing for it but to temper it to the seedlings by an admission of fresh air. It needs the brain behind the hand to do this with the maximum amount of benefit to the plants and the least possible chance of doing harm. The experienced man knows which way the wind is blowing, and this decides him as to which vents to open and how wide. He opens those on the lee side, and if a free ingress of air is needed he reaches it by degrees. He appreciates the fact that the tender foliage is laden with heated moisture of the same temperature as the house, and that a too sudden douche of cold air might easily chill and blight it. So, when we insist upon the importance of leaving the ventilation of the houses in skilled and experienced hands, we feel we are on very safe ground indeed.

Enemies

Possibly the most difficult thing in the cultivation of plants under glass is that of keeping them free from a swarm of enemies. Growing, as they do, under unnatural conditions, they are peculiarly susceptible to the attacks of various diseases and insect pests which the said conditions encourage.

Once they are permitted to gain a foothold it takes a strenuous effort to eradicate them. We have seen disease spread from plant to plant in a tomato house so that within twenty-four hours not a single plant could be found entirely free.

Green fly, mealy bug, thrip, scale, red spider, every one of which is a hideous foe, have an uncanny way of appearing from nowhere. A too dense humidity, a burning aridity, a stagnant atmosphere will bring them out in battalions and breed them in such quantities that the work of extermination becomes exceedingly difficult and costly. As we hope to show, it is far easier to prevent attacks than to cope with them afterwards. Not only is it wise to make use of well-proved deterrents, but, knowing the dangers that are always present and potential, we are ardent advocates of the hygienic treatment of plants. Hygiene has done much to ameliorate the conditions under which the human race exists; it has done as much for animal life, and we know that it can prove as beneficent to plant life. It is possible to avoid that excessive humidity; to prevent that searing aridity; to cleanse and purify that stagnant atmosphere, and thus remove their baleful influences. The charge-hands who neglect these essential safeguards are not fit to be entrusted with the care of the houses. If they do so through ignorance, they are proved incapable; if they do so through negligence, they should be discharged.

Cleanliness

Absolute cleanliness is the first rule of hygiene. A dirty house is a breeding pen for everything that is bad. A hothouse should always be clean, not only because it is more pleasing to the eye, but because it is essential to the health of the plants. Every second year the inside rafters should be given a coat of good oil paint. The brickwork should be limewashed every

year, and all woodwork scrubbed with soft soap to which sulphur or some other such agent has been added. The glass itself needs washing down two or three times during a season, for the accumulations of dirt obscure the light. The air should be filled with that subtle and gratifying sweetness, so suggestive of healthy growth and well-being. The paths, if tiled, ought to be swilled down daily; if they be cinder or gravel, they should be swept clean at least once a week, or oftener if any rubbish has accumulated upon them. With us, "cleanliness is next to godliness." In the greenhouses it comes first.

SHADE

The question of shade, or partial shade, enters into the general management of the houses; but as this is almost entirely governed by the nature of the plants grown, we are unable to lay down specific instructions. We shall, however, refer to it again and again as often as occasion suggests.

Speaking generally, roller blinds are far and away the most effective form of shading, but their installation is much too expensive to admit of general use. The great objection to permanent summer shading painted on the glass, whether it be whitewash, "summer cloud," or a smearing of clay, is that when you would like to remove them on a dull day you are not able to do so. We have seen positive injury done during a prolonged spell of dull weather, the absence of sufficient light being deleterious to the health of the plants. For this reason, we look upon movable shading material as being, in the end, more effective and economical, and would prefer blinds made of tiffany, scrim or matting rather than opaque sail-cloth. The object of shading is not primarily to exclude light; rather it is to arrest the direct rays of the sun, diverting them from such plants as are not sturdy enough to withstand them.

The points we have here raised in some detail must not be skipped over as being of little importance. In very truth, they are extremely important; we might almost say "vital." They are observations we feel called upon to make, for through nearly a half-century of practical experience they have forced

themselves upon us. They are such as "those who run may read," and if they will carry the teaching into their daily practice it will save them from many a pitfall.

CHAPTER II.

PROPAGATION

The propagation of young plants and their subsequent cultivation up to a definite given stage is the principal work of the nurseryman. For this his whole place is organised, his staff employed. For this he constructs houses, pits and frames. The propagator is his chief of staff, well versed in the various devices for increasing stock. The amount of stock raised, its condition and its saleable qualities are the stock-in-trade upon which he conducts his business. He has nothing else to sell. What he does not, or cannot, raise, he has to buy and then sell again, sometimes for little gain.

We cannot exaggerate the importance of the propagator, for the success or failure of the business depends in a great measure upon him. Our ideal propagator is a man of some considerable attainments, informed on matters not, at first sight, directly to do with his practical duties. He is of trained intelligence, a keen observer, a thinker—carefully methodical, conscientious. Not imbued with the spirit of "ca' canny" or working ever with his eye on the clock, but one who can win the entire confidence of his employer as well as that of his fellow employees.

So much for the man; now let us look at his work. This we shall deal with in some detail in so far as it has to do with ordinary market plants, leaving the after-cultivation to be dealt with in further volumes. And if the number of subjects dealt with are disappointingly limited, we can only say that rarer, costly, unmarketable plants and crops are beyond the present purposes of this book.

There are two principal methods of increasing stock, viz., from seeds and by cuttings. Other methods are: divisions of roots, grafting, layering, budding, etc.; but for the present we will devote ourselves to the raising of seedlings and propagation by cuttings.

Raising Plants from Seeds

The sowing of seeds appears, on the face of it, to be a very simple process indeed; but done on a large scale, with commercial success or failure in the balance, it is by no means the perfunctory operation some take it to be.

It is not enough to say, "Follow Nature," for, in the matter of seed sowing, Nature is far too wasteful in her methods for us to imitate her. In her riotous plenty, she will scatter a thousand seeds to insure that one will grow. There is, however, a sense in which we shall do well to follow her lead. By watching her we can select the best time of year at which to sow various kinds of seeds; we can note the meteorological conditions under which they germinate and grow; avoiding her wastefulness, we can imitate, or even improve, her methods of scattering, of covering, of watering. By observing her, we can inform ourselves as to the most congenial soil and surroundings for any particular genera and species. For example, in the matter of lime, there are certain plants, like the Cowslip, which cannot live without it. There are others to which it is obnoxious, while again there are others quite indifferent. Some plants demand heavy soil, others light, and it is well to inform ourselves on these points before we sow seeds, for surely it is advisable to introduce new life into conditions which thousands of generations of plants have proved to be the most congenial.

In every department of nursery work the motto must be: "Thorough." "Muddling through" can never be made to pay. Whatever the task, it must be set about in a businesslike way, if for no other reason than that it *is* business. When about to sow a quantity of seeds, get everything ready to your hands. See to it that an ample supply of suitable compost is prepared; that the pots or pans or boxes are cleaned and well crocked for drainage; that the requisite space is awaiting them as they finally pass from the hands. Nothing is more annoying to a man, immersed in his work, than to find, just as he is going strong, that he must leave off to prepare more compost or to make room. Much of his zest passes off in such a break.

How to Sow Seeds

Pots, pans or boxes, whichever are used for seeds, must be well drained, clean and dry. Half inch to a whole inch of broken pot sherds, according to the depth of the vehicle, make an effective drainage. Over these sherds should be placed an inch or two of coarse siftings from the compost heap as an efficient retainer of the finer soil used in the bulk. (See Fig. 1.) All foreign particles, such as wood or stone, should be picked out, for whatever compost is used it should be clean. We lay stress upon the cleanliness of the pots and pans, but we would still

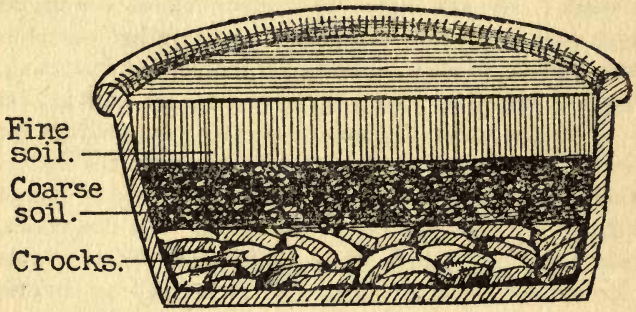

Fig. 1.—Pan Prepared for Seeds.

more emphasise the need for cleanliness in the soil. It is the medium in which the tenderest things in Nature, the root hairs, have to explore and from which they extract all that goes to sustain the life of the plant. This medium must be pure.

Having laid this coarser compost over the crocks, the vehicle should be filled level with the prepared compost, and this must be firmed down, first by the fingers, then with a "presser" (see Fig. 2), till its level surface is 1 inch below the rim. Why with the fingers and then with the "presser"? Because the fingers penetrate and make firm the lower levels, while the "presser" firms and levels the upper layer only—thus we have equal pressure throughout, and this in itself is desirable.

When filled, stand the vessels upon a level bottom and gently water with a fine rose until the whole of the compost is thoroughly

saturated as evenly as though it had been standing out in the rain. The old-fashioned way, and by far the best way, too, where the quantities to be handled were not too large, was to immerse every pot or pan in a tank of water, holding it there until thoroughly soaked. But where hundreds have to be done this is considered too slow, and the saturation can be as fully assured by a watering pot and fine rose. The compost is so charged with moisture that there is a sufficiency to last until the seeds have germinated—that is, so far as seeds with a reasonably rapid germination are concerned, like most annuals.

After saturation, a little while should be allowed for the superfluous water to drain away, and then the seeds should be sown evenly, thinly and regularly upon the surface, pains being

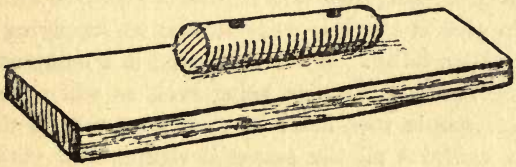

FIG. 2.—A " Presser "

taken to see that they do not cluster together or lie too thickly to allow space for the healthy development of every seedling. The old adage, " Sow thickly, thin quickly," has long been exploded, for practically nearly every seed may be expected to germinate if the conditions be favourable. We emphasise this point, because it so often happens that the thinning or transplanting cannot be attended to at the psychological moment and the young plants, growing quickly, run up weakly. Let " sow thinly " be the rule, then the plantsman is better able to select his own time for the transplanting.

At what depth should seeds be sown ? Those sown in the open ground are usually put in about four times that of their own thickness, but this rule does not hold good with seeds sown under glass, where the conditions are all under control.

Some seeds are so fine that they need no covering beyond a mere dash of silver sand—for example, Begonia, Calceolaria,

Lobelia, Ferns, etc. They are exceedingly minute and germinate freely on the surface of the soil if due precautions are taken with regard to moisture and exclusion of a too strong light. With most other flower seeds it suffices if they are just covered with a light coating of soil to prevent their exposure after watering, and for this $\frac{1}{16}$th or even $\frac{1}{8}$th of an inch is ample.

Germination is accelerated if sheets of brown paper are spread over the seeds to exclude both air and light, but when this is done, as it usually is, care must be taken to remove the paper directly germination can be seen to have taken place; for, as soon as a plant begins to grow, it needs a certain modicum of light and air, without which it cannot develop healthily.

Preparing the Compost

Seeds and seedlings do not require a compost rich in plant foods. To give it them is as irrational as supplying rich food to a newly-born baby. What they need is a compost prepared on hygienic lines, its texture being such as will encourage the tender microscopic root hairs to push out and do their work, but which contains all the essential elements of plant food in their mildest form—porous, a container of heat and moisture, so that the seedlings may not be starved and stunted, nor forced into a soft and unhealthy growth, a prey to the first disease floating around.

A good general compost, to suit the ordinary run of bedding plants, but which may be modified or corrected to the requirements of most species, might be as follows: One barrowful of old pasture loam; one barrowful of old soil previously used, but standing at least six months in the open; one barrowful of well-decayed leaf mould; a half barrowful of old hotbed manure; one peck silver sand (coarse); half gallon powdered charcoal. This should be heaped and well mixed, then passed through a $\frac{1}{4}$-inch sieve, the siftings to be used to half fill the pots or boxes, and the finer soil to make the seed bed. It is very necessary to sift the compost to remove the larger lumps to which the young roots would otherwise adhere, for this would result in breaking them when transplanting. The $\frac{1}{4}$-inch sieve is sufficiently coarse to redeem the texture of the soil from being

powder, for if too fine it is very apt to become "pasty" under frequent waterings, in which state it becomes sour and detrimental to life. Soil, when too fine, becomes a bad medium—it does not function aright, in that it lacks that perfect aeration so valuable to healthy growth.

The best of soils are not in a condition for use when they are either too wet or too dry, the ideal state being, that, squeezed in the hand it falls apart, not too rapidly, when the pressure is relaxed. A wet soil would cling together, a dry soil would not take the pressure but run rapidly apart, and this action is reflected when the compost is placed in the pot or the pan. If wet it is impossible to press it into the required density, and if too dry it refuses to be pressed and also becomes partly impervious to water. This may be considered by some to be a trivial matter, but it is really very important indeed, and it will be found that it is such small matters that are the more important.

When to Sow

There is scarcely a month in which seeds, of one kind or another, may not be sown to advantage, so we have thought it advisable to present, in calendar form, some table of sowings which may be helpful.

The list of plants we give must not be considered complete, but as fairly representative of marketable varieties. It will be easy, even to those whose knowledge is limited or elementary, to add other plants according to their classification. It must further be borne in mind that all the sowings we refer to are calculated as being made under glass.

Month.	Varieties of Seeds.
January..	Begonias, Cucumbers, Melons, Tomatoes, Sweet Peas.
February	Antirrhinums, Cannas, Coleus, Cyclamen, Gloxinias, Lobelias, Petunias, Salvias, Celery.
March ..	Half-hardy Annuals, Aralias, Asparagus Plumosus, Carnations, Cucumbers, Melons, Tomatoes, Marrows, Mimulus, Schizanthus.

Month.	Varieties of Seeds.
April ..	Further Half-hardy Annuals, Dahlias, Streptocarpus, Ridge Cucumbers, Grevillea, Ferns.
May ..	Cinerarias, Primula Sinensis, P. Obconica, P. Malacoides, Trachœlium, Late Asters.
June ..	Calceolarias, Hardy Primulas, Auriculas.
July ..	Successional Cinerarias, Primulas, Calceolarias, Schizanthus.
August ..	Cyclamen, Grevillea, Asparagus Sprengeri, Smilax, Aralias.
September	First sowings of Tomatoes, Cauliflowers.
October ..	Sweet Peas and further Tomatoes.
November	Tomatoes.
December	Tomatoes.

CHAPTER III.

SEEDLINGS

We will take it that our seedlings are well up and that they have unfolded their cotyledons. They are extremely sensitive to their surroundings, and will speedily wilt, wither and die unless all the essentials to their well-being are afforded them. Light, air, moisture, meticulously measured, are what they need; not bursts of hot sunshine, not blasts of cold air, not copious floodings with water, but carefully modulated proportions of these essential elements.

So then, directly their seed-leaves have formed, they should be placed in the full light of day, though for a day or two they must be shaded from sunshine. The atmosphere about them must be kept moving—that is, a slight current of air must pass through the house, for it is the nitrogen thus brought to them that imparts strength and vigour. In a few days the seedlings will be sufficiently strong to stand sunshine, to enjoy more air, and also to enjoy sufficient moisture to counterbalance the evaporation always taking place when air is admitted.

At this stage, while comparatively rapid growth is going on, a pan of seedlings can make such headway as to create a very real danger for themselves: viz., that of "damping off." The

preventive measure is to prick them off as soon as they are large enough to handle, and this, as we have before pointed out, goes to prove our point in favour of sowing thinly. Until such time as "pricking off" can be attended to, the watering of the seedlings is a very delicate task, for whether overdone or not sufficiently watered, the "damping off" is almost inevitable. Experience alone can impart the skill to effect the happy medium.

Transplanting

"Pricking off" or transplanting into stores is the first important operation in the life of a seedling, and this work, though so simple that it may be entrusted to juniors, really requires care and a due regard to the building up of the plant. Pots, pans or boxes, whatever vehicles are used, should be prepared in the way we explained for seed-sowing, but the compost used may contain a larger proportion of plant foods, though it must not err on the side of richness. It must be well firmed, though not hardened, in order to make a secure anchorage for the roots to lay hold of, and this will ensure a more perfect drainage than if it was soft and loose.

With a small dibble, made of any hard wood about 6 inches long, make holes in the soil, but only to a depth which permits the roots to touch bottom. This question of depth is very important, for many thousands of seedlings perish every season through being "hanged" in the soil—that is, there is a space between the tips of the root and the firm bottom of the hole, so that the root cannot find holding and feeding ground. Lift the seedlings carefully, prising them up with the dibble, then separate them carefully so as not to break the slender roots, which must be dropped perpendicularly into the hole, being held *in situ* with the thumb and finger of the left hand. Then with the right hand select a spot an inch away from the hole, and press the dibble in diagonally, aiming at the base of the roots and making the soil firm about them. Aim at the roots and not at the stalk. Novices usually are concerned to make the plants tight about the collar, but the expert takes little heed as to whether they are tight or loose at the collar, provided

the roots are holding firmly enough to resist a slight effort to pull them up.

On no account must stem or root be bruised by contact with the dibble or the death of the plant is almost certain. After a little practice even a novice can avoid that and in a very short time he will be able to handle the plant safely and rapidly. Quick work is desirable, but the beginner is most seriously urged to learn to perform the operation correctly and deftly before he begins to think of doing it quickly—that will come all in good time.

The distance, in transplanting, from plant to plant is regulated by the habit of the plants. Tomatoes should be 2 inches from plant to plant; Lobelias and many other small things may be given 1 inch as the absolute minimum, and that only on the assumption that they are going to be potted off when strong enough.

In the spring it is always advisable to keep the sun from newly transplanted stuff, and to keep them reasonably moist and close until they have taken hold. Then they must gradually become inured to more natural conditions, so that they do not run to a soft but to a vigorous and fibrous growth. It is possible for the constitution of any plant to be made or marred at this early stage of its existence, just, indeed, as possible as it is to ruin or make the future man or woman in the days of infancy.

The admission of air to newly transplanted seedlings needs considerable discrimination. At first it must be admitted grudgingly; but when in the full vigour of youth they begin to romp away, then the admission of air must be handled as a corrective, to prevent a too rapid growth and to build up fibre and tissue rather than soft, sappy flesh.

Generally speaking, seedlings when growing should be kept near the glass to prevent them drawing up weakly and to give them the fullest benefits of light and air.

Antirrhinums

If there is any one bedding plant that has come more than another to the front during the past few years it is the

Antirrhinum. Its popularity increases with every improvement made in it, and these are many and often. We know several firms whose annual distribution of this plant ranges from 50,000 to 100,000. Its value is enhanced by reason of its being a two-season plant. Sown in July, plants are raised to flower in the late spring; sown in February, the product is for ordinary summer flowering.

A fair collection would comprise 60 varieties—that is, 20 varieties each of Majus, intermediate and dwarf. Even so, many meritorious varieties would not be included. We sow always in boxes, the July sown being stood in the open, with or without protection, and the seedlings are transplanted into prepared beds or into cold frames. Usually the stock is sold out by the end of October, but any residue would certainly be transferred to frames, for it is only in the warm counties that it can be safely wintered in the open air.

We are not greatly concerned with these, seeing they have little to do with the houses. It is the February sowing we have most to do with, for the greater part of the time before being planted out they have greenhouse treatment. For the sowing, we use boxes 15′ × 10′ × 2½′, and also for the transplanting. Sow thinly in moderately good well-drained soil and darken for a few days. The seeds will germinate in a week, when the shading must be removed and the boxes stood in the full light. Transplant them when large enough, 48 to a box, using a fairly generous compost composed of loam, manure and leaf-mould. Use no crocks, but put an inch of rough manure and leaf-mould in the bottom. There being no great depth of soil, and the plants having to do their bit entirely in the boxes in which they are first transplanted, the manure or leaf-mould act as a wet nurse, and holds and feeds the mass of roots which quickly appear.

Do not attempt to grow Antirrhinums in strong heat; the temperature of an ordinary greenhouse is warm enough. When they have developed four pairs of leaves, nip off the top. Plants not so stopped become attenuated and weak, and will never become satisfactory.

The young plants require very careful watering, for standing

in the full sunlight, the soil, being shallow, dries out, so that on a sunny April day, while yet the plants are under glass, they should be watered morning and evening. It is a great advantage then to remove them to a cold frame to harden and strengthen them.

Our own firm opinion is, that it is up to the nurseryman to show what an Antirrhinum is capable of, and thus do his best to promote its popularity and increase the demand.

Market men will have noted what a splendid subject this is for a pot plant to bloom in April, and will have admired the thick heavy foliage and the massive flowers brought on to the market. The 48-sized pot is the one generally used, and there is yet some room for developing this line. They can be grown in spare frames or in cold houses, even under peaches and vines. A little old cow manure in the bottom of the pot will do wonders in promoting a deep green foliage and large flowers, for though this is a plant exceedingly tenacious of life, thriving in any cranny or crack it can anchor a root to, it undoubtedly does its best when the treatment is good and the soil enriched.

Cannas (Indian Shot)

The Canna will always find a useful place in garden schemes, and nowhere more so than in the informal, natural borders now so widely taking the place of the formal and artificial. Its bold, upstanding and conspicuous foliage, combined with the richness, lightness and elegance of its flowers, imparts a somewhat tropical tone to the beds, lifting them far above the ordinary stereotyped bedding we have grown a-weary of. Grown as pot plants, our illustration shows how useful they are.

There are several named varieties of the Canna, but their propagation by divisions of the roots is not a very rapid one, for it takes quite a good plant to quadruple itself in any one season. Still, as this is practically the only way of propagating named varieties, it has to suffice.

After the plant has bloomed, its foliage dies off and the roots are stowed away for the winter. In early spring they are overhauled, divided and potted up in a soil containing a modicum of sandy peat. As a matter of fact, the finest

Cannas, drawn in October from Seeds sown in March

collection of pot plants we have seen were grown in Jadoo fibre, and were the property of the late Colonel Thompson, of Jadoo fame. The potting should be not later than early March, as, if it is intended to make a long summer display, the plants ought to be well advanced and established in 48's by planting time. Only by getting them well forward can we see their capabilities. These named varieties command the better sale, seeing they have been selected for their outstanding merits, being, as a rule, of better habit and larger flowers than the generality of those grown from seed.

The finest strain of seeds is that emanating from the famous French specialist, M. Crozy, most others being at a discount. Sow the seeds in February or March, and as they are hard as shots and double the size of Sweet Pea seed they are worthy of their common name of Indian Shot. They should be soaked in tepid water for 48 hours before sowing, and even then take four to five weeks before germinating, after which their growth is rapid. Pot them into 60's and keep them on the go, choosing for them a stage in the full light and amply warmed. It will be June before they are large enough for sale, but because they are ornamental even before the flowers come they sell readily enough when ready.

Cinerarias

While the Cineraria can be propagated by taking the off-shoots from old plants after blooming, this is seldom resorted to unless it is desirable to perpetuate some particular plant. It is best to treat it as an annual or biennial and raise from seeds. There is certainly no better known or more popular spring-flowering greenhouse plant, and we know of some nurserymen who annually distribute many thousands of seedlings.

The first sowing might be made about the middle of May, and if grown on, the resultant plants should flower at the end of the year. But larger sowings should be made in June and early in July, to keep up the succession and to offer as seedlings to " the trade." Sow thinly in pans or boxes, using a compost not likely to run dry too quickly, say, half loam, half leaf soil and some silver sand. Prepare a good drainage, whether in

pans or boxes, fill up level with the compost, press firmly and evenly, leaving a level surface, then water heavily with a fine rose. When the superfluous moisture has drained away, sow the seed thinly and cover lightly with fine soil, sifted, from the same compost. Stand in a cool shady part of the house or frame—no bottom heat required—and cover with some dark material, like brown paper, to exclude the light. Let us say here and now that Cinerarias are throughout their whole growing period averse to heat. They always call for cool treatment.

A week after sowing, the seeds will germinate, and, at once, the covering must be removed, and they must have light and air. A fortnight after this (or shall we say three weeks ?) the seedlings will be large enough to handle and, being peculiarly susceptible to " damping off," they should be pricked out as soon as possible, allowing each plant about 2 inches of space in which to develop. In another month they should be large enough to meet trade orders for seedlings, a portion being potted into 60's to meet the demand for them in that form. Those required for selling as flowering plants will eventually find themselves in 48's, a very handy market size. As we shall be treating of this size plant in a later volume we will not enlarge upon it here.

The young plants must, we repeat, be grown cool. The greenhouse in summer is no place for them ; they prefer the cold frames, which, for them, should slope to the north. The leaf-mining maggot and the green fly will devour them unless this treatment is given, and, as the latter is a most determined enemy, a daily syringing, as a preventive, is more than desirable.

Herbaceous Calceolarias

Here we have another one of those spring greenhouse plants that is impatient of heat. Provided that it is protected against frost, the cooler it is grown the better it is. Requiring more attention than most of the plants we are now treating of, it is not such a simple matter to cultivate it from seedling to flowering plant, otherwise we might be tempted to ask, " Why

so many failures?" We would hazard the opinion that in too many instances it receives too much attention, which amounts to "coddling," and this brave, braw, hearty plant refuses to be coddled.

Like the majority of market plants, the Calceolaria has received due attention from the hybridiser, and he has evolved a magnificent strain, dwarf in habit, giant in bloom, dazzling and pleasing in colour. Why, then, do some growers still adhere to the strains in vogue thirty years ago? We know not.

To the grower for market it would simply be suicidal to sow seeds of an obsolete strain just because the seeds were cheaper, and he must in this, as in all his doings, rely upon the best and nothing but the best. He lights somewhere upon a strain that is perfect—he procures it and sticks to it until he finds something better. That is adamant fact.

When the seeds of the Calceolaria are sown in June and July, the pots or pans in which they are sown should stand in a particularly cool, shady place. The summer heat of any glass-house is too great for them—a pit, or even a temporary frame, facing north is far better. The seeds are of the finest, and need no further covering beyond a little sand. The soil should be sandy loam with a little leaf-mould, sand being essential. The seedlings must be grown under the same cool, shady conditions and never allowed to dry. Six weeks after sowing they should be ready for pricking off, and a compost similar to that in which the seeds were sown should be used. In September, pot them into 60's. At this stage, or again when potting on, the compost should be fibrous loam, with cow manure, a little garden refuse ashes, with sharp sand.

We must not look upon the Calceolaria as a winter-flowering plant, for, being so impatient of heat, it ought never to be hurried, so that if our forward plants bloom in March, that is early enough. Successional plants will extend their season for three months. Grow as near to the glass as possible, and if on shelves the supply of sufficient water must be most carefully maintained. Allow them to become dry and you extend an invitation both to green-fly and disease.

Cyclamen Persicum

This is truly a winter-flowering plant and is held in the greatest esteem. Its merits are all its own and there is no other plant with which we can compare it. It is a very old favourite, and it has kept pace with the times, for, compared with what we knew it to be a generation ago, its flowers have taken on new colours and finer forms. From comparative insignificance it has become one of the most important pot plants from a market point of view, and the fine examples coming into the markets for about six months out of the year find a very ready sale.

Its cultivation is remarkably simple, calling rather for unremitting care and attention than for skill. Almost invariably it is grown from seed, the individual seed itself developing into a small corm, throwing out roots from its base and foliage from its crown. Under favourable conditions practically every seed germinates, though it takes three or even four weeks to do so. Years ago we saved the corms from year to year and obtained quite satisfactory results from them, as much as nine or ten years old; but, though some growers still do this, it is found more economical to raise new plants from seed every year, if the desiderata be marketable size plants.

Seeds should be sown in January or February and again in August. We ourselves rely upon the later sowing for our best plants, as, without special treatment, these have ample time to make first-class market stuff by November in the year following.

As soon as the seedlings have thrown up a leaf, they are large enough to transplant either into store-pots, pans or boxes, using an ordinary mixture of loam, leaf soil and sand. Then when four leaves have developed, they should be potted into 60's, and will stand in these until April. We begin to pot them into 48's (their flowering pots) in batches, picking out the strongest each time. Firm potting in a rich soil is advisable, and sometimes we put a little old cow manure just over the crocks. They must be grown in frames or pits during the summer months, where they can have space and an abundance of air; but of their cultivation from this stage we shall treat later. We will now only, once again, insist upon the importance

1 month

3 months

9 months

Cyclamen Persicum Giganteum

(*a*) 1 month, (*b*) 3 months, (*c*) 9 months after sowing.

of growing a good strain, with massive blooms of a pleasing range of colours. There are several such strains in the market, and the grower must exercise his own discretion as to which he grows, after having satisfied himself as to its particular merits.

Tuberous Begonias

The tuberous Begonia is easily and quickly raised from seed, providing it has sufficient heat and moisture. Sown in January or February, fine plants may be ready by the middle of May in time for bedding out. Seedlings are more often used for this purpose than for growing as pot plants, and they may be relied on to come generally true to colour. This applies to both singles and doubles, though the finest-named varieties for pots are grown from cuttings.

The seeds are very fine and, when sown, need no covering beyond a sprinkling of silver sand. They should be sown in small pans, using a generous but finely-sifted soil, not too heavy. When the pan is filled with soil well pressed down and levelled, it should be immersed in water and then allowed to drain. Upon this the seeds are sown thinly and not watered again until it appears to be dry—say, a fortnight. Bottom heat is essential to quick germination, and the minimum temperature of the house should be 60°. Cover the pans with glass and exclude the light until the seeds have germinated, then immediately remove the glass and admit light. Transplant into similar soil as soon as they can be handled, still using bottom heat, though when they are large enough for single pots that may be dispensed with. They like a moist heat, not an arid one. In April they should be gradually inured to cooler conditions, and in May ought to be ready either for the cold house or for frames, so that they might be hardened off before being sold for bedders. The pots should be well crocked, as drainage is important. The soil we have found very suitable is one-half loam, chopped; one-quarter old hot-bed manure; one-quarter leaf mould, sifted; and a few handfuls of coarse silver sand. Pot firmly, and do not water the plants overhead.

Gloxinias

This handsome hothouse plant is not everybody's flower, and the number of nurserymen who grow it in quantity might almost be counted on the fingers. But there are certain houses where it is still a leading and paying line. Given an extra-special variety—named—it is readily propagated from leaf cuttings, but a really choice strain of seeds will produce varieties as good as can be desired. Treat the seeds and the seedlings exactly as laid down for tuberous Begonias, but grow on in single pots in a hothouse. Flower them in 48's and market them. The foliage rather resents contact with water, so that care must be taken to water the plants without wetting their leaves.

Primula Sinensis

Chinese Primulas are amongst the brightest, best-known, and most useful of winter-flowering plants. The fimbriated forms, both single and double, and the stellate forms are in great demand for the decoration of table, window, and conservatory. Though perennial, they are treated as biennial, and raised every year from seed.

There are Primulas *and* Primulas, and it is true economy to pay a slightly enhanced price for the seeds, to make quite sure of procuring the finest strain. By "finest strain" we refer to those with the largest fimbriated flowers and the choicest range of colours, and these can only be procured from those seed growers or merchants who have established a name for their strain, and who have a reputation to lose. It is also advisable to grow them to colour, an advantage made possible only within the last few years.

The first sowing may be made in May, and further sowings in June and July for successive batches, a proceeding rendered necessary whether the plants are intended for sale as transplanted seedlings or as flowering plants. Like Cinerarias, Primulas prefer cool treatment, harshness and aridity being poison to them. Partial shade should be afforded them during their earlier stages—those stages which are included throughout

their summer growth. At a later stage they appreciate the autumnal and winter sunshine, but even a fully-grown plant would suffer if it had to face the August sunshine under glass.

The seeds are nearly as large as onion seed, so that they may easily be distributed evenly over the surface of the soil. This should be fairly heavy, but rendered perfectly porous by sand and a little leaf mould. If thoroughly saturated before the seeds are sown, no further waterings are necessary until germination has taken place. This will be in a fortnight if a covering of brown paper has been applied. Then remove them to the full light, barring sunshine, and directly the first pair of

FIG. 3.—Box of Transplanted Primula Seedlings

leaves have developed, it is time to transplant. Grown in partial shade, they speedily reach saleable size as transplanted stuff, but where large quantities of plants are required for pot work, they should be potted when they have reached the stage as illustrated by the box of transplanted plants shown above.

PRIMULA OBCONICA AND P. MALACOIDES

The vast improvement effected in P. Obconica during the past ten years has brought them more to the front as decorative plants, and their further development may with confidence be anticipated. P. Malacoides is still sufficiently novel for its undoubted merits to receive full appreciation, and the giant forms it is now assuming will undoubtedly establish it in popular esteem as a market plant. Therefore, with P. Obconica it is worthy of our attention. We treat them together because they

are so nearly related and call for almost identical treatment—at least, in their early stages.

Both should be sown in June and July. But here we must have a special word. We have seen many failures in the germination of these seeds, not through any inherent fault, but simply because they were subjected to conditions inimical to them. The seed pans have been stood in greenhouses or frames where they have not been sufficiently protected from the direct rays of the sun, or, where coverings have been placed, the temperature about them has been allowed to run up higher than it should. Further, we have noted the ill effects of irregular treatment, the surface of the soil being sometimes too wet, at others, dust dry. There are really few plants that can successfully negotiate such treatment, but most certainly they cannot be found among the Primulas.

There is one other danger. We have seen a splendid germination, the young plants have developed their leaves, transplantation has been in sight, and then great havoc has been made by woodlice. This can be guarded against by raising the seedlings where the bed on which they stand can be always kept damp, for if woodlice like one thing more than another it is dryness. And when we say keep the bed damp, we do not mean wet. Too much moisture will cause damping off—in plant culture extremes are always dangerous. Reason must control every condition.

P. Malacoides, sown in June, may be flowering freely in 48's at Christmas, but P. Obconica will not be so advanced before March. Both should be transplanted directly they are large enough to handle and afterwards potted, first into 60's, say, about the end of August, and then into 48's at the end of October. A good compost for most Primulas is a barrowful of chopped turfy loam, one-third barrowful each of pulverised cow manure and sifted leaf soil, with half a peck of coarse silver sand. The sand is very important, it gives tone and secures porosity. The potting should be firm without being hard.

Ferns

Ferns require a full measure of heat and moisture during their initial stages. What they do they must be induced to

do quickly, otherwise they become unprofitable. Their cultivation on a large scale is a work for the specialist, and there are several establishments within a certain area of London devoted entirely to them. The varieties mostly in vogue are Adiantums, Cyrtoniums, Nephrolepis, and Pteris in variety. These are all raised from spores, or seeds, and require no elaborate or ambitious structures to grow in, thriving rather in low, warm, and half-shaded houses where warmth and moisture are provided; indeed, we have seen them flourishing like weeds in broken-down and dilapidated structures where it was no pleasure to view them.

But while Ferns are so complaisant as to certain conditions, they do, we maintain, demand cleanliness, and this is not always so easy to ensure them where a dense humidity exists night and day. Yet it can be and is amply secured in those large London nurseries where fern culture is so highly specialised.

Fern spores are very minute—finer than dust—and must be sown without covering on a level surface. They are so sown by Nature, and in the semi-darkness caused by the thick frondage they germinate readily. We try to reproduce those conditions by sowing and watering and shading and heating, and these, if efficiently provided, will encourage a good germination and eventually a healthy generation.

Like unto other seedlings, the baby ferns require pricking off very early, so that each and every plant may healthily build up its own constitution. When this is first done, it is well to keep them in their moist, warm quarters until they are good enough to pot singly, and even then these same conditions can with advantage be continued.

Many thousands of baby ferns pass through our markets annually, in 72's and 60's, but the ideal market fern is a well-developed plant established in a 48, with healthy deep-green fronds. Such ferns are grown on the stages of low-built houses by highly specialised labour, though there is no secret in their cultivation and practically little difficulty where whole houses are devoted to them. The compost used is very similar to that of the Devon and Dorset lanes and banks where ferns abound, a sandy loam with old leaf soil.

The fern-grower is always careful to leave nothing to chance

in the way of drainage, and sees that every pot is suitably furnished with the necessary means.

Schizanthus Wisetonensis

Years of selection have done much to eliminate whatever was objectionable in the habit of this interesting plant, and to improve its coloration. Hence it has taken its place as a desirable plant, especially for early greenhouse work. Seeds should be sown in July in a close, moist place, and germination may be expected in five or six days. We have already insisted upon the fact that directly seeds have germinated their exposure to light is essential, but there is no plant to which this more particularly applies than the Schizanthus. It springs up so rapidly that twenty-four hours' delay in exposure handicaps the young plants for life, for it develops long weak stalks no thicker than threads.

The well-being of this plant depends entirely upon a short, sturdy growth, and to encourage this it must be grown near to the glass—preferably on a shelf, where, however, it must never be left to dry itself out. By quickly transplanting from the seed pan, this habit is promoted, and the same promptness in moving in to single pots has the same happy result. By the end of August the plants should certainly be in the 60's and standing in a shallow frame on the shady side. In October they will be more than ready for their flowering pots and should then be stood in a light greenhouse on a stage not far removed from the glass, where they must be given ample space. They are as easy to grow as parsley if their surroundings are congenial.

As they make great demands upon the soil, this must of necessity be rich and should be composed of old turf and cow manure, with sand, all chopped up together in preference to sifting. If the loam is consistent and not turfy, then a little sifted leaf mould should be added to prevent compression, because though the Schizanthus is an easy subject, it needs all it can get to perfect its root system. It should never be allowed to dry, nor should it be over-watered. Over-watering deranges the drainage, and it is imperative that this be perfect.

It should be grown in a house where a free circulation of air is provided for every day, and might be wintered with the Cinerarias.

The Schizanthus is grown as a summer plant, though perhaps not so largely. For this purpose the seeds are sown in February and March, but care must be taken never to coddle the young plants in a high temperature.

Foliage Plants

Apart from Ferns, there is a whole group of foliage plants raised from seed which at least demands our passing attention. They are Aralia Sieboldii, A. Moseri, Asparagus Plumosus, A. Sprengeri, Grevillea Robusta, Smilax, and some others of the

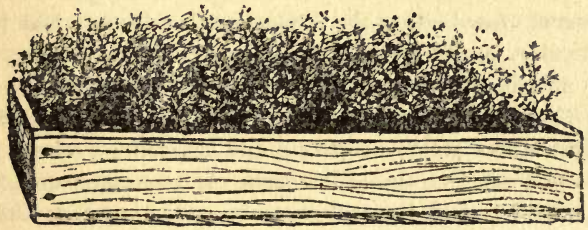

Fig. 4.—Box of Transplanted Asparagus Plumosus

Dracœna family. The Asparagus and the Smilax are grown chiefly for cut stuff, the Aralias and Grevilleas as pot plants. They are all in healthy demand and the number grown each year amounts to many thousands; hence they make a very important line. The seeds may be sown in spring and again in autumn, those sown in spring being fit for sale to the trade as small stuff in autumn, and those sown at the end of August being ready by March. They are not difficult to grow, but had better be treated as greenhouse plants, not as hothouse.

When preparing to sow the seeds, we mix a compost of loam and peat in equal portions and add liberally of coarse silver sand. This is a compost that is "springy" rather than solid, and one that retains moisture and heat. Special attention is given to drainage, and when the pans are prepared we take the seeds one by one and place them in regular lines at about ¼ inch apart.

In February and March we sow in heat; in August the natural heat of a shaded greenhouse is sufficient.

Sometimes the seeds take a month to germinate, this probably being influenced by the age of the seed, and when they once start they should be kept active. Daily sprinkling is very advisable, for on the least sign of dryness, red spider and thrip both attack the young plants, and we have seen cases of neglect where scale and mealy bug have also been found with the others. Aralias and Grevilleas should be potted into 60's as soon as they are strong enough, but we do not as a rule hurry the Asparagus and Smilax into single pots—it will be time enough for them when they have developed further.

The trade will purchase most of these *ex* or *in* 60's, but the market asks for larger stuff in 48's. One further point is important—never crowd either the Aralias or Grevilleas. The former, in particular, easily spoils if crowded, for it is a fairly rapid grower and its leaves are large compared with the size of the plant. Therefore it needs space, practically as much as Cinerarias, if the leaf stalks are to be strong and the foliage robust.

With reference to the cultivation of Asparagus and Smilax for cutting, we shall treat of these in good time, but the stage we have brought them to now is the stage at which they are, as a rule, sold to wholesale buyers.

Tomatoes

Though we deal with the cultivation of the Tomato in Vol. II of this work, we deem it advisable to treat of the seed sowing and early stages here in its proper place.

Within the limits of our own practical experience, Tomatoes have sprung from a position of utter insignificance to the foremost place as a market nursery crop. Many hundreds of thousands of pounds have been invested in that particular industry, as a visit to certain districts around the London area will amply demonstrate to the curious and interested. Range after range of hothouses and an army of skilled workers are devoted almost entirely to Tomato growing, and as an industry it plays an important part in our economic system.

The demand for the luscious vegetable-fruit is ever increasing, and though the Channel Islands, Belgium, Holland, Spain, and the Canary Islands pour thousands of tons each year into our market, to say nothing of the almost incredible amount of tinned Tomatoes from Italy and America, the home grower is still on the flood-tide simply because there are no Tomatoes like the English Tomatoes, and certainly no better growers than the English growers.

In view of their tremendous importance they demand a close study, and at no time are correct methods and treatment more important than during the initial stages in the life of the plants.

First, then, as to the choice of seed. We say nothing about varieties, because progress is so rapid that the favourite of to-day may become obsolete in a year or two and our remarks become ancient history. What we have to talk about are those things that are permanent and which will endure as long as the Tomato itself. Choose your seed, if possible, before it has been harvested ; in other words, select the ripe fruits and harvest your own seed. Choose it from sources untainted by disease. Be exceedingly exacting as to that. Choose it between midsummer and July, for then you will procure the best ripened seeds. Avoid coarse fruits just as you will avoid small fruits—let them be perfect, solid, and of richest colour. Select them from the second and third trusses, as these will have perfected themselves without the vicissitudes incidental to the first truss. Every little point in their favour is worth considering, and, come to think of it, how big these little things are !

Let us, for clarity's sake, tabulate these points :—

(1) Select ripe, well-developed fruit, and harvest the seed yourself.
(2) Choose it from sources free from the suspicion of disease.
(3) Choose it between June 21st and July 31st.
(4) Avoid coarse or otherwise imperfect fruits.
(5) Select them from the second and third trusses.
(6) When cleaned, see that the seeds are thoroughly sun dried.

Tomato seeds vary a little in size according to variety, but there should be about 6,000 to the ounce, and if the number in

a tested ounce shows considerably more than that, it may be suspected that a portion of them are not as plump and perfect as they ought to be. The test of germination is not a sufficient test and is not a good criterion as to the health and vigour of the seedlings.

The Tomato is a coarse and vigorous growing plant, and because of its intensive cultivation becomes the objective of numerous enemies both insect and fungoid, therefore it is advisable to begin the fight against these from the very beginning.

As to the time of sowing, this must be governed by when you want your crop to turn in. If you aim at forcing the plants to catch the high prices of April and May, then you will sow your seeds in October or November. If, on the other hand, you have to content yourself with a coldhouse crop, then January is the proper month. You want neither to have your young plants ready and languishing in pots before you are ready to plant them, nor find yourselves wanting them before they are ready—therefore some discrimination as to the time for sowing is necessary. Further, as conditions in various places are not identical, one nurseryman by reason of better facilities producing his plants more quickly than another, it would be folly on our part to dogmatise by fixing arbitrary dates. What we rather recommend is that every man keep his own data and rely upon his own proved experience, which is tuned to the facilities at his command. If we could put this clearer, we would, but we are growers, not writers, and we think our words, crude though they may be, will be understood as between growers and growers.

Just now we pointed out how advisable it was to combat disease and pests from the beginning. We return to that and would reduce it to practice.

Prepare your seed and thoroughly cleanse it by treatment with formalin, which will destroy all germs or spores which may have settled upon it. Sterilise your soil, and if no other method of doing this is convenient, let boiling water help you. Fill your boxes all ready for the reception of the seeds—stand them perfectly level, then thoroughly soak them with boiling water from a fine-rosed watering pot. To be effective the soaking must be thorough. Half an hour afterwards you may sow the seed.

The soil used should be new soil consisting of loam, leaf mould, and sand. Though it must not be rich, it is false economy to use old, spent soil, just as it would be a mistake to mix manure with it. Press this soil firmly, sow the seeds evenly and thinly, cover lightly. After the soaking with hot water, no further wetting is needed till the seeds are up. If sown in heat they will be above the soil in a week, but there is a very common error made by standing the boxes or pans just over the hot-water pipes and thus forcing the first growth. This is reprehensible, for it is bad for the constitution of the young plant from which you expect so much later on. Rather, let the earliest stages be leisured, for so only can they conduce to strength.

Immediately the seedlings begin to pierce the soil expose them to the light and as near to the glass as may be convenient. Light and air will prevent them running to stalks, which ought not to exceed ½ inch in length. Transplant them while yet only the cotyledons have appeared, and give every plant at least 2 inches of space for its very own. Be sure the soil is well firmed, for from first to last, as we shall show later, the Tomato will grow most sturdily and bear more heavily in well-firmed soil.

When the transplanted seedlings have developed two pairs of leaves they are ready for potting into 60's and in this size should make ideal plants for the plantation; but should the latter not be ready for them, then by no means allow them to remain in such small pots and thereby deteriorate, but go to the necessary trouble and shift them into larger pots. It will be labour well spent.

The atmosphere the young Tomatoes thrive in must not be overcharged with humidity. We always consider them as comparatively "dry" subjects, enjoying moisture at the roots, but not among the foliage. They do enjoy and must have a free circulation of air, without which they grow soft and lose their constitution.

CHAPTER IV.

CUTTINGS

The art of increasing plants by means of "slips" or "cuttings" goes back through the ages, as indeed do most

of our garden practices, for horticulture is the oldest of all professions, and innovations of any serious nature are practically unknown. Where any species of plant has several varieties, seeds cannot as a rule be depended upon to reproduce the varietal characteristics, though be it admitted that selection and re-selection through a number of years has done much to "fix" distinctive features. It is still right, however, to say that a grower can only be certain that his stock is pure when it has been propagated from cuttings of the original. (Cuttings in this sense would include "grafts.")

A simple example of this is the Lobelia. Seeds of such varieties as Emperor William, Mrs. Clibran, Bluestone, etc., are sown every year by nurserymen. A very large proportion come true to name, but a minority are variable, and if only one or two rogues get planted among the others they are unsightly. In a bed or in a ribbon, Lobelia plants must be uniform in habit and alike in colour, or the scheme is marred, and for this reason all the best stocks in the country are propagated from cuttings.

In addition to this, some of our most popular plants do not yield a sufficiency of seeds to perpetuate their race and number. The Zonal Geranium is an example, and if there were no method of propagation other than by seed, this deservedly popular plant would speedily become scarce and expensive. Another point—this same Zonal will serve to typify another feature, viz., that its seedlings are totally unsuited to the particular purpose for which Geraniums are usually required, where the desiderata are moderate growth and an abundance of bloom. If we take a seedling and grow it on, its growth will be profuse, probably gross, and its blooms very few. Indeed, until it has attained considerable proportions it simply refuses to bloom, and cuttings taken from it will be in flower before the parent plant.

We give this as a practical illustration of our remarks, and though we are not here concerned with the scientific reasons for this, we might say, in passing, that the root system of a seedling differs materially from that of a cutting. The one is produced in Nature's old, old way, the other, also natural, has been artificially promoted. The difference between the two is well known and turned to advantage. The grower of roses

appreciates the difference. Where he has deep and heavy soil he uses the stock of the seedling brier because the roots strike down; but when he has to do with lighter and shallow soil he relies upon the brier cutting with its lateral surface-rooting system.

It is well that these fundamentals be brought to the notice of all who engage in commercial horticulture, for it helps to root

FIG. 5.—Soft-wooded Cutting made at a Joint

FIG. 6.—Hard-wooded Cutting made with Heel (Rose)

out that empiricism which has been the bane of the profession for generations past. The "why" and the "wherefore" are things that matter, and to know them is "as a lamp to the feet."

What, then, is a cutting? As the word itself implies, it is a portion cut from a plant with the intention of creating another.

As a rule it is cut from the current season's growth, wood of an older growth being slower and more diffident in emitting roots. It must be **solid** growth, not necessarily hard, as that depends entirely upon the character of the plant from which it is cut. It may be a terminal growth 3 or 4 inches long, as is the case with the generality of bedding plants, or it may be a modification of the "slip" and have a heel of older wood at the base. Speaking generally, for we dare not dogmatise where there is no fixed rule, the cuttings of soft-wood plants are cut immediately below a joint (see Fig. 5), and hard-wooded subjects, which are of slower growth, are cut with a heel. (See Fig. 6.)

A cutting should always be taken from a *healthy* growth, and contain within itself a store of food upon which it can exist for several days. The fact of its being severed from the parent plant and otherwise mutilated, should not do more than check and modify the flow of sap within certain limitations—that is, if it is properly done—while the special treatment given should be designed to "wet nurse" it until the natural action of the sap shall have created for itself the means of support by the emission of roots. This special treatment may be summed up in three words—moisture, warmth, shade.

When to Make Cuttings

At this stage of our work we purposely limit our remarks to that class of plants which, without detriment to their full appreciation, we may term as "ordinary," on the ground that they are everybody's plants and are always in demand. This constitutes them at once as the nurseryman's plants, because it is obviously his business to grow what he is quite certain to sell. Those we are about to enumerate are all proved sellers, ignored only by those who specialise in other directions, but with whom we are not here concerned. Most of the species may be and are raised from seeds, but the select varieties can only be perpetuated by means of cuttings.

Arabis, Double and Variegated .. in June.
Bouvardias .. .. .. ,, April.
Begonias, fibrous rooted .. .. ,, ,,
Calceolarias, shrubby .. .. ,, September and October.
Carnations, perpetual flowering.. ,, February.

Chrysanthemums	in November, February and March.
Coleus	,, April.
Dahlias	,, March and April.
Ericas	,, May.
Fuchsias	,, February till April.
Geraniums	,, August and September, March and April.
Heliotropes	,, March and April.
Hydrangeas	,, August and September.
Lobelia	,, September, March and April.
Marguerites, Single and Double	,, September and October.
Pansies	,, June and September.
Petunias, Double	,, September, February till April.
Poinsettias	,, May.
Salvias	,, September, March and April.
Violas	,, September and October.

The plants in this list, which is by no means exhaustive, naturally divide themselves into two sections :—

(1) Those that require the protection of glass during a short period without heat.

(2) Those that require warm treatment and are essentially greenhouse plants.

Under Section 1 the plants are practically hardy, but for commercial purposes are best propagated in cold frames, and thus come under the heading of " cultivation under glass." They comprise Arabis, Calceolarias, Marguerites, Pansies, Phlox, Penstemons, and Violas.

Under Section 2, the Poinsettia is a hothouse plant, Bouvardia and Erica are greenhouse plants, as are also fibrous-rooted Begonias. Fuchsias, Coleus, and Carnations may also be classed as greenhouse plants, though they are sometimes made to do outdoor service. The following are summer bedders : Dahlias, Geraniums, Heliotropes, Lobelias, Marguerites, Petunias, Salvias. The Chrysanthemum stands in a class by itself and is divided into various sections according to its natural time of flowering—earlies, semi-earlies, November, and late flowering. The Hydrangea is also a " solitaire," a very popular line as a pot plant for early blooming in the greenhouse, or planted out as a summer-flowering shrub.

We have thought it more convenient to deal with them alphabetically, rather than in their respective classes, so having set out *when* the cuttings should be made we will describe *how* to make them and the treatment they require.

CHAPTER V.

PRACTICAL CUTTING MAKING

Arabis Albida Flora Plena and Variegata

Many thousands of this plant are sold year by year, and because it is a good selling line it comes under our observation. No artificially created heat is required in its propagation, but a suitable bed must be prepared upon which a frame and lights may rest. In making this bed, first of all procure and lay down a sufficient drainage of old pot sherds or other hard material. This should be covered with several inches of decaying leaves or the coarse siftings from the compost heap. Above this about 4 inches of sifted and sandy soil, covered with a good sprinkling of silver sand, will make the bed in which the cuttings are to be inserted. The cuttings are made from the young growths, and as the wood is exceedingly brittle, the knife used must be very sharp. Make them about 2 inches in length and remove one or even two pairs of leaves so that they may be inserted from 1 to 1½ inches in the bed, the soil of which will have been pressed firmly down. In making the holes use a small dibble and see that it is not too deep for the bases of the cuttings to rest on a firm bottom. That I consider vital, no matter what subject we may be dealing with. One and a half inches from cutting to cutting, with 2 inches between the rows, is a convenient distance to insert, for though this space seems small, the cuttings remain *in situ* so short a time after being rooted that it suffices. Immediately they are inserted they should be well watered with a fine-rosed pot to settle the soil well around them and to supply that moisture which they are unable to seek because of the want of roots. Then the lights should be put on and covered with shading, no air being admitted for about two weeks, unless it is necessary to let out superfluous moisture. It will take three or four weeks before they make any sign of rooting, and during that period they will require a slight sprinkling daily. They are almost bound to wilt, and the first sign of rooting is that the leaves stiffen. When this has gone on for about a week it is well to remove the lights altogether.

We have dwelt on these details rather fully because their essential features apply to other cold-frame subjects, and a reference to them will prevent repetition.

Calceolarias (Shrubby)

This well-known bedding plant is one of the indispensables. There are two distinct colours in several varieties, the bright yellow and the crimson bronze. The yellow is in greatest demand because it contrasts so brilliantly with the reds of the Geranium and the blue of the Lobelia, a conventional but popular combination. Thus, for every bronze Calceolaria propagated there are probably six or eight yellows. Directly the autumnal frosts threaten, the cuttings should be taken. If the plants have done well there should be at least a score of good cuttings on every one. They are made from the young top growths and generally from 2 to 3 inches in length. Cut immediately below a joint and remove the bottom pair of leaves, not breaking them off, but cutting with a sharp knife. In the longer cuttings remove two pairs of leaves. The bed should be made for them as recommended for the Arabis, and should be firmed by treading once over it. A rather more plentiful supply of silver sand is advisable, for it is astonishing how the very peculiar roots of the Calceolaria revel in sand.

For some time the frames should be kept close and water supplied to the cuttings very sparingly, only sufficient to prevent their flagging. Though the nights will be growing cold, the warm October sunshine will necessitate shading. When sharp frosts come the frames must be well matted, as it is essential that the frost should be excluded as much as possible. When the cuttings have rooted, a degree or two of frost does not hurt them, but it must not be too severe. Watch them well throughout the winter, watering them whenever a favourable opportunity occurs, and on like occasions give a change of air, increasing this when February brings the promise of spring.

In March growth will begin, and if the cuttings are too crowded they will grow weakly and spindly. They should therefore be carefully lifted, part of them potted into 60's, part boxed, and the other part replanted 3 inches apart. But this may be modified according to the trade they are intended for. When grown for "the trade" they should be sold at this stage without transplanting at all. The local trade will take the potted plants, the open market the boxed plants, and those transplanted into

the frames will further supply the local market, and serve also for planting out for stock purposes.

Dahlias

The Dahlia is not now so high in popular esteem as it was a quarter of a century ago, but that has made little difference in the demand, except for new varieties. Though it is apparently less enthused over by the specialists, everybody who has a garden will continue to plant it because of its intrinsic merits, and we have little doubt that, as we gradually get back to normal conditions, the "cult" will again take it up with all its old fervour. We look upon it entirely as "good stock."

To begin with, we cannot do better than take our stock plants when they have finished their summer's work and have been cut down by frost. We cut the growths down to within 2 or 3 inches of the ground and carefully lift the root intact with a spade. Shaking off the soil, we carry these roots to an airy shed or even stand them on the stage of a greenhouse to dry. Then we stow them away in a warm, dry place for the winter, after carefully tying the name to every one.

In February we bring them out, clean and trim them, and place them in a warm greenhouse, so that early in March they begin to put out young shoots. When considerable numbers are handled these stock roots are neither potted nor boxed, but are half covered with earth, kept moist, and a position is chosen for them ensuring both heat and light. As a rule, each root throws up quite a large number of shoots and each of these is a potential cutting which, if cut close to its base where its wood is most solid, will, under proper conditions, almost inevitably strike. It must not be allowed to grow more than 3 inches before being taken, otherwise the wood will be hollow and useless as a cutting. Though the Dahlia is a very soft-wooded plant, and in the cutting state peculiarly susceptible to "damping off," the risk is greatly minimised by taking the cuttings in the woody state described.

Insert in store pots, 48's are the best size, using light sandy soil with a surface of silver sand. When finished, the pots should be immersed in a pail of water and then plunged in the

propagating bed, the temperature of which should be 60°. Aired every morning and sprinkled with water of equal temperature, these cuttings should be rooted in a week. After another week they should be potted off into 60's and stood in a warm house for a fortnight, then taken to a cooler house and gradually

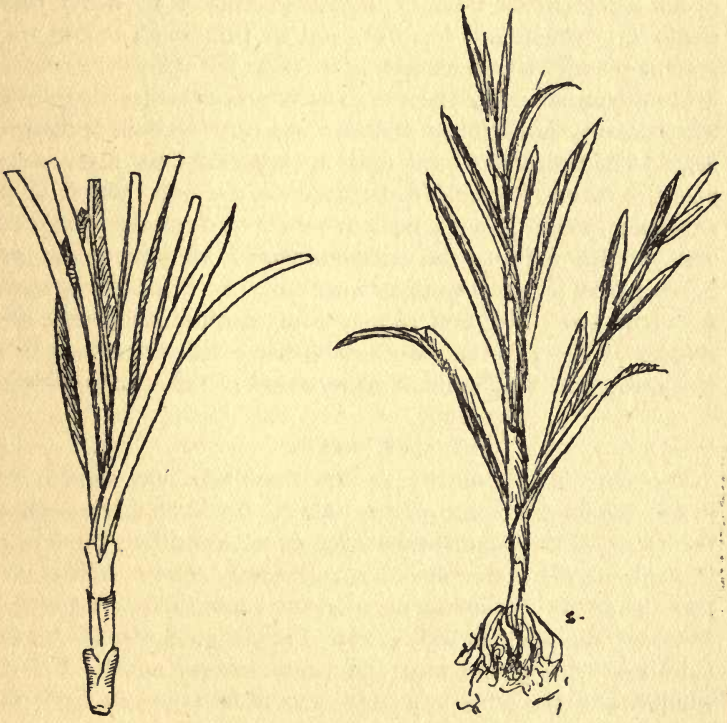

FIG. 7.

Carnation Cutting Rooted Carnation Cutting

hardened. Early in May a cold frame suits them very well, and by the middle of the month they are saleable.

CARNATIONS (PERPETUAL FLOWERING)

The greenhouse Carnation, about which we shall have more to say in a later volume, has become perhaps the most valued of all our greenhouse market flowers, not even excepting the Chrysanthemum and the Rose. Its season is a long one, from

October till May, and indeed one might say " all the year round." The most practical method of propagating it is from cuttings taken from side growths in February. These cuttings may either be cut at a joint (see Fig. 7) or " piped "—that is, " pulled " like Pinks—and sufficient of the grass removed (cut) to make a stem of not less than an inch. Our own practice is to insert them singly in " thimbles " in sandy soil so that when rooted they may be potted on without feeling a check, but specialists who do many thousands strike them in pans, boxes, or propagating beds. They are easy subjects and will root in a very few days on bottom heat. The propagating pit must be kept close for a few days, and the cuttings sprinkled, but this is the only period of its existence when the Carnation requires overhead watering. The soil for striking the cuttings should be porous and not heavy ; that for potting them into might be of coarser texture, say, half loam, half leaf soil, a dash of sand, and some lime rubble. When they are once established a temperate heat is all that is required, for this plant rather resents a higher thermometer.

Bouvardias

The old-time popularity of the Bouvardia has waned, but it still has its place as a market plant and will hold it so long as the taste for the beautiful and the sweet remains. Its demerit in modern eyes is that it is not sufficiently showy, that it does not flaunt its flowers as do so many plants that are popular. Provided the plant is well grown it is yet good enough for the most exclusive greenhouse and conservatory, as also for the window and the table. Cuttings should be taken in April and May from young growths produced after the old plants have been cut back. Inserted in open, sandy, though well firmed soil, about 12 to a 48, and plunged in bottom heat, the cuttings readily root. After they are rooted they do not need to be treated as " hothouse," but as " greenhouse " plants, the principal difference being that they like plenty of fresh warm air. They need but two shifts—from cutting pots to 60's, and later from 60's to 48's. Care must be taken to make them bushy, so as soon as the young plant has become established in its 60 pot and made 2 inches of growth, the top must be nipped

off, and it is when the succeeding breaks have made satisfactory progress that the final shift into 48's should be given. Then again, when established, and not before, these new breaks should be pinched, and finally each plant must be supported by a neat stick about a foot long, and the side shoots looped to it.

Begonias

Fibrous-rooted Begonias are essentially greenhouse plants, of which Gloire de Lorraine is a high type. Tuberous-rooted Begonias are both greenhouse and bedding plants, showing more to advantage as the former, but more generally adapted to the latter use. The fibrous-rooted section has been grown for a century or more, and we can remember such kinds as Weltoniensis, Prestoniensis, Fuchsiaoides, etc., for the past sixty years, but can claim to have seen the beginning of the tuberous-rooted section and to have grown them from the time of their introduction. We have already referred to the method of raising single and double tuberous Begonias from seed, but have now briefly to allude to the propagation by cuttings of choice-named double varieties and the drooping varieties introduced but a few years ago.

Having started the tubers by placing them in heat about February, they send out several growths, and these, as soon as they are from 1 to 2 inches long, are severed at their base from the tuber and inserted as cuttings in a sandy, peaty soil with bottom heat. They are not difficult to strike, but on the other hand, a tuber produces only three or four cuttings, so that their increase cannot be said to be rapid. If the cuttings are well watered in they will require but little additional moisture until they are rooted, which will be in about a fortnight. Pot them off when this takes place and keep them in a hothouse until they are established, then gradually remove them to a structure less heated but still warm.

Cuttings of the fibrous-rooted varieties may be taken in March and April, inserted in sandy soil with a good bottom heat. If in pots, plunge them into the propagating bed and keep the lights closed except for a half hour daily. They respond best to warm treatment and ought not to take their chances among

ordinary greenhouse plants, but have a warm corner to themselves. Since the Gloire de Lorraine section has been introduced, this and its varieties have eclipsed all the earlier known varieties because of its exceedingly floriferous habit, but there are many growers who would be glad to see it freer of growth at the expense of some of the bloom. Several firms who specialise in it do it to perfection, but those of us who have no special facilities for its culture cannot hope to attain the same high standard of excellence. Nevertheless, there is nothing to prevent the turning out of very creditable plants.

Chrysanthemums

This is one of those plants which are grown in greater or lesser quantity by every nurseryman. Its general merits are such as to recommend it to everyone, but if it possessed only half the merits which may reasonably be claimed for it, it would just as certainly be largely grown as the flower to bridge the gulf between the seasons.

It has an exceedingly long season, for though it is at its best and highest value from November till February, flowers may be had at Easter, at Whitsuntide, and onward throughout the summer. Further, it is one of those double-cropping subjects of peculiar value to the grower, inasmuch as it gives an adequate harvest of blooms and afterwards produces such large quantities of cuttings that their sale realises quite as much as does that of the cut bloom.

We have no space here to indulge in reminiscences, but whenever we write of " mums " our memory goes back to the days when Fair Maid of Guernsey and Elaine represented the latest thing and were considered the acme of perfection among the whites, while Jardin des Plants occupied the same position among the yellows—when the majority were of the pompom type and the Japanese were no larger than a double Pyrethrum of to-day. What strides we have witnessed !

Let us take now our usual course and show how stocks are multiplied. When the plants have finished flowering they are not neglected and stood aside, but are as carefully tended as any other plant beginning its season's growth. They receive

every encouragement to throw up healthy cuttings and plenty of them. The late large-flowering varieties often throw up their new growth while yet the plant is in bloom, and these may be taken as cuttings directly they are fit, but with the earlier-flowering section, including the November kinds, February has, in practice, proved early enough for all practical purposes to take cuttings.

The production of strong healthy cuttings, should, as we say, be encouraged, but that does not imply that they should in any way be forced. We never subject our old plants to heat, but allow them to take their natural course under normal conditions, viz., cool treatment. Not that there can be any serious objection to a heat which excludes frost and does not rise (except by sun heat) above 50° in winter. There are exceptions: a few varieties are exceedingly shy of growth and simply will not produce cuttings unless they are assisted, but these are the exceptions which prove the rule, and, on the whole, we may take it for granted that a cold frame will turn out stronger and better cuttings than a greenhouse.

Cuttings should be made of short firm growths, real basal growths, before the wood hardens. All puny, thin growths should be shunned, unless they are novelties which must be increased rapidly. Let them be about 2 to 3 inches long, cut immediately below a joint. Remove the lower leaves with a sharp knife that will cut clean without bruising. Use a light sandy soil for them to root in, avoiding all nitrogenous matter, and whether in beds, pots, or pans do not crowd them or their rather ample and soft foliage will arrest and hold too much moisture and "damp off."

Even the cuttings do not need great heat. In the South of England we have stood pots of cuttings in cold frames in November and they have remained there throughout the winter and done well; but in the Midlands and North, where the bulk of the propagation has taken place in February and March, we have found a little heat very helpful, if not indispensable. And indeed when the numbers to be propagated amount to many thousands heat must be used to accelerate rooting, but it is rather the exigencies of trade that demand this, not the well-being

of the plants. Any disadvantage to the young plants is countered by a system of hardening, and every firm of repute resorts to this before distributing the rooted cuttings.

According to the time of year, the cuttings, under ordinary treatment, will take from three to five weeks in rooting, and directly it is observed that they have done so they should be stood in a light airy place where they will be encouraged to consolidate rather than grow. Those intended to be grown on as pot plants should be potted in good soil as soon as they are well rooted, while those grown for the wholesale trade or for planting out, should be boxed, but not thickly.

Do not try to keep your young stock in the houses when the sun begins to be powerful in March and April, for then they will almost certainly be attacked by the leaf-mining maggot, like Marguerites. Get them out into the frames, keeping then fairly moist and well aired, so that they do not become leggy and hard.

The cultivation of young Chrysanthemums on a large scale is very fascinating, and though specialised labour is necessary for very large stocks, the ordinary nurseryman whose stock amounts to a few hundreds finds it quite practicable to grow them with other stock, using intelligent though not specialised labour. It is in their later stages that special skill is called for, and this we shall again take up when dealing with the further cultivation of this popular and valuable flower.

Zonal Geraniums

The Geranium is still the best-known and most generally used of all summer bedding plants, and is consequently the principal one grown for that purpose by nurserymen. Its propagation is remarkably simple and easy if only its few elementary wants are provided for. Spring and autumn are the recognised times for making cuttings, not because they will not strike as well as others, but because they are the most convenient. Those struck in the autumn are handled then because cuttings are abundant, more than at any other season; those struck in the spring are from young growths capable of making useful-sized plants by the time the bedding season comes, at the end of May. But as a matter of fact, Geraniums strike with

almost equal facility during any month of the year, providing they are given a suitable temperature. To be more explicit, they will strike in the open air from May to October, but require a reasonably dry heat from November till April. In practice,

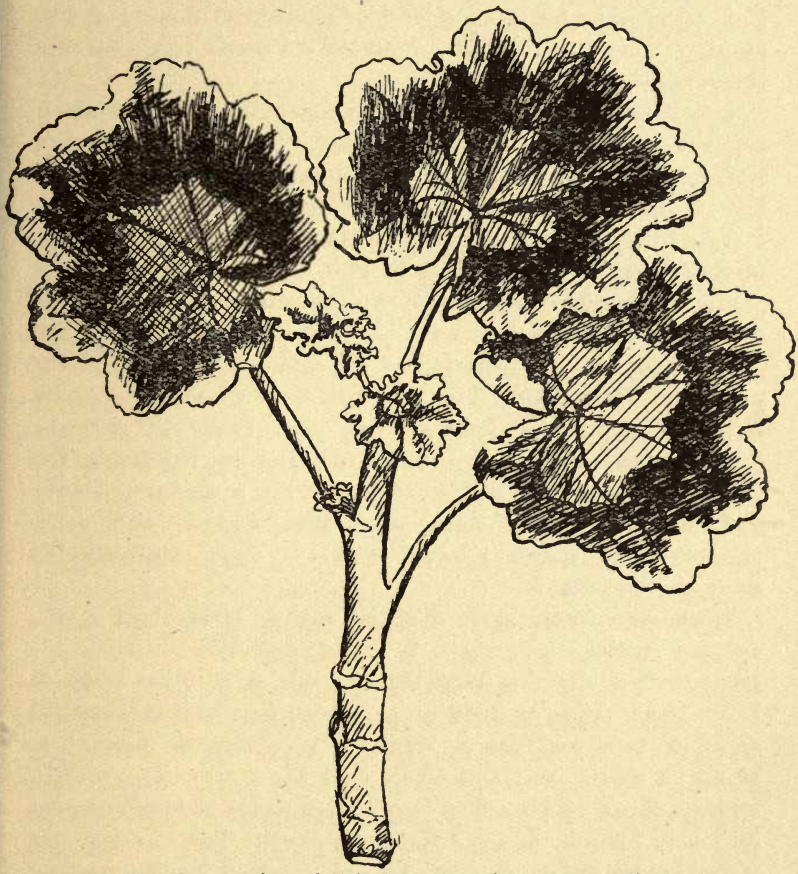

FIG. 8.—Cutting of Tricolour Geranium (Mrs. Pollock)

however, it is only when it is imperative to increase stock of particular varieties that the process is carried on throughout the year.

The great bulk of cuttings is invariably made in August and September from plants grown for that purpose as well as for

decoration. They are put thickly into store pots, pans, or boxes, and stood in the open air fully exposed to the sun. In about a fortnight they take root, but are in no way interfered with until the approach of frost makes it advisable to house them. It is possible to house considerable numbers in limited space, for they remain in the stores until potted singly in spring into the pots in which they are sold.

Young tops of good solid growth make the best cuttings—soft and sappy growth being very liable to rot off during bad weather. Pot plants give but a limited number of cuttings, but as they are usually firmer, shorter-jointed, and better matured they make the best of cuttings, and over 90 per cent. of them may be relied upon to root. A nurseryman who is planting Geraniums out for stock purposes sees to it that the soil in the beds is well firmed, because only in really firm soil can the kind of wood be produced approximating to that of the pot plants in quality. A variety like Paul Crampel naturally tends to rapid and soft growth, and that can only be corrected by making the soil solid and in regulating the supply of moisture. Flower of Spring has a similar tendency and calls for similar treatment. Mrs. Pollock and other tricolours are sparse growers and are more amenable to generous treatment.

While we entirely agree that the putting of the bulk of the autumn cuttings into stores is sound, especially on economic grounds, it is our own invariable practice at all other times to insert them singly in small pots, and we find that this method gives us very satisfactory results. A cutting so inserted in March is well rooted and established by April; it can then, without check, be potted on into a large 60 for bedding, or even into a 48 for sale as a pot-flowering plant. But the best pot plants are those from cuttings specially inserted for that purpose in small pots in August and grown on during the winter. Early in February we behead them (incidentally increasing our stock), and as soon as they begin to break we put them into their flowering pots. Still growing them on, we can dispose of them as extra large bedding stuff in 48's at a good price, or market them as specimen plants in bloom at a still better price.

We obtain the greater part of our spring cuttings from old plants boxed up in the autumn, and this is a by no means unimportant source of supply. We are within the mark when we say that these despised old plants (too often thrown on the rubbish heap) are a very valuable asset, and between February and April we invariably get three batches of cuttings from them. After that if we think advisable we plant them out again for stock, but if they are not needed for that purpose they are thrown out. The method of making cuttings is shown in the illustration, and it only remains for us to insist upon the need of using a sharp knife. Let there be no rough surgery, no bruises. Quickness is very commendable, but let the beginner learn first of all to make the cuttings *well:* quickness is sure to follow with practice.

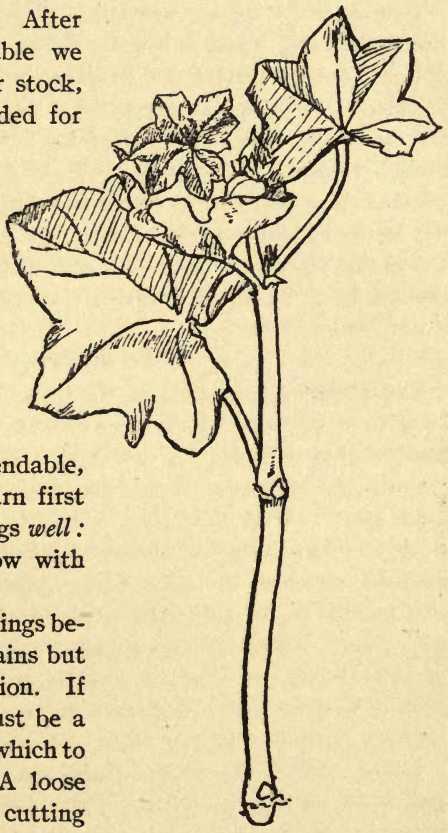

FIG. 9.—Cutting of Geranium (Ivy Leaf)

The making of the cuttings being complete, there remains but a word as to their insertion. If put into stores there must be a sufficient depth of soil in which to embed them securely. A loose soil and an unsecured cutting means lost labour, so whether pots or boxes be the vehicles used, the soil must be reasonably firm and the cutting made tight. This soil must not be heavy. It is of the first importance that it be porous, for the question of moisture throughout the trying winter months is most critical.

Wetness is almost fatal, and to be dust dry is nearly as bad. The healthy conditions of the roots can be maintained only if the soil about them is warm and slightly moist, and this can be quite assured if the drainage is in good working order. This point must receive attention when the pots or boxes are being filled—it cannot be done afterwards.

Just a word as to wintering the plants and cuttings. A warm, dry, airy house is best for them. They need an abundance of light, so that shelves and stages near the glass are their proper positions. A temperature of about 55° is high enough, as there can be no object in forcing winter growth which in the nature of things is bound to be weak. The fact that they are natives of South Africa ought to be borne in mind and be some guide as to the method of treatment. Loam, leaf mould, and rotted manure will make a good compost in which to put them, and this operation ought to be finished during the first half of March or earlier if convenient.

Poinsettias

The Poinsettia, because of its truly brilliant colour, furnished at a time of year when vivid scarlet is scarcest, is grown in considerable numbers for the market both as a decorative plant and also for cutting. It is a deciduous stove plant and requires brisk heat. After flowering, it has to be well ripened by the gradual withholding of water, and just before the new growth may be expected in the natural course to begin, it should be well headed back and cuttings made of the matured wood then cut away. These cuttings should be made from below one joint to just above the next, that is, to give them an eye at bottom and an eye at top. We have seen every joint made into a cutting, but consider the other the safer.

Insert around the edges of pots at 1½ inch apart, using peat and sand as the compost. This must be well firmed down. Plunge in the propagating pit and keep close till growth commences, when it will be seen that rooting has also begun. Pot on into a similar compost to which a little loam has been added and continue close treatment.

Poinsettia Pulcherrima, the best-known variety, is apt to grow tall, and this may be obviated to some extent by growing

in full light and not far from the glass. Supposing the cuttings to have been taken in March, they would be potted into the 60's at the beginning of May and into their flowering pots by mid-August. Always treated indoors, the time of their flowering can more or less be regulated for any given time between mid-December and March.

The Fuchsia

The Fuchsia is surely venerable among market plants. It has seen many others come, stay their allotted time upon the stage, and pass away into the limbo of things forgotten, while, as to itself, it remains perpetually green and young because it stands alone.

It is somewhat of a phenomenon to see a flowering plant in so many varieties remain practically stationary at a high level of popularity for at least forty years without the fillip of new and improved forms to sustain it there; yet it is a fact that the leading varieties of to-day are still those grown by our grandparents. Mrs. Marshall, Lucy Finnis, Frau Emma Topfer, Countess of Aberdeen, Phenomenal, Try-me-Oh, Tower of London, and Sunray were on the front bench in the seventies and eighties and are there still.

We state this interesting fact without discussing it, our simple duty at present permitting us only to point out its outstanding merits as a marketable plant and to show how to propagate and grow it. Its merits are not obscure; they are:—

(1) It is easy to cultivate.
(2) It is popular among all classes: is "everybody's" plant.
(3) As a decorative plant it is exceedingly effective and never out of place.
(4) It has no rivals, for there is nothing like it.
(5) It is most inexpensive.

If as much could be said for all market plants it would revolutionise the trade. Fuchsias are grown from cuttings. They can be raised from seed, but only a few enthusiasts in quest of novelties take that trouble. This may be a pity, for though we have pointed out the utter lack of improvements during recent years, we have not sufficient temerity to suggest

that they are unimprovable. On the contrary, we have in mind certain definite lines along which improvement might be sought. But to the point. It is correct to say that for all practical purposes Fuchsias are grown from cuttings inserted either in the autumn or in the spring—more generally the latter—which are taken as early in the season as possible. The old plants, after their period of rest, are overhauled in January, pruned and top-dressed, then subjected to warm, moist conditions to induce quick and healthy growths. As soon as the young shoots are large enough they are made into cuttings, being severed from the plant near their base, which is found to be fairly solid. We strike the earliest in shallow pans of sandy soil stood in the propagating pit, but as spring comes on we do not allow them such a valuable position, for they will strike in beds on the benches of the house if only they are kept shaded.

Their first watering is at the time of insertion when, if they are in pots or pans, we dip them in a pail of water, holding them level till completely saturated. If, on the contrary, they are in beds, we give a thorough soaking through a fine rose, to settle the soil well around them. This watering being so thorough, the cuttings will need naught but a light sprinkling daily to refresh the foliage, requiring no further watering until rooted. In about three weeks after insertion they will be ready for potting, and this should be into a clean wholesome compost of loam, leaf soil, and sand. Pot them fairly firmly into 60's and stand on stage in warm house. They will soon be established and making a free growth.

As with other plants, so it is necessary with Fuchsias to avoid overcrowding. If they are for selling to the trade they will now have reached a saleable stage and should be got rid of as soon as possible to make room for their successors; but if they are for market work they must never be allowed to stand still. There should be no great need to pinch them back to make them bushy, because the potting on from one size to another generally acts as a natural check to top growth and answers the same purpose. Indeed, the natural bias of the plant is towards the pyramidal, and those large one-year specimens seen in the autumn are built up by the frequent potting from one size to

a larger, so that often there has been no need to pinch back a single shoot.

But the growing of specimens is a side issue and not at all in our way. We are out to deal with the market plant in bulk, viz., those in 48's and in full bloom. Directly the young plants are really established in the 60's they should be removed to 48's and grown in a light, airy position. If they fail to break into growth from the lower eyes, then they must be "stopped" and made to do so. Give them a good rich compost consisting of two parts chopped turfy loam, one part chopped cow manure well rotted, one part sifted leaf soil, and a small portion of silver sand. Crock the pots well, pot them firmly, and do not water copiously until growth restarts. Their after-treatment is along very simple lines—space, light, air, warmth, and not too much moisture.

A portion of these may need the support of a thin stick, either to hold the plant erect or to which the side shoots, heavy with flowers, may be looped, or for both purposes.

HYDRANGEAS

The buyer of plants who wants something to look at can get all he needs from the Hydrangea. The most exacting buyer who ever entered the market will, we think, admit that when he purchases one of the many offered for sale at Covent Garden he has got plenty for his money. We see them in thumb pots like caricatures, with tiny bodies and immense heads; we see them in 60's with heads of bloom a foot through; we see them in 48's with two monster heads, and in 24's like to mountains of pink and of blue. How are they grown? We reply, "Surprisingly easily." The merits are those of the plant rather than of the grower. Cuttings are taken from large permanently planted stools grown for the purpose. The end of August is the best time, and the cuttings are the top growths which in many cases have already formed a crown which contains the rudiments of the following season's flower. They are made from 2 to 3 inches long and inserted singly and firmly in small pots. Very often they are taken to market in the same pots they occupied as cuttings.

The best place to stand them is a cold, shady frame. Water them heavily when they are put in and sprinkle every morning to keep the large and clamorous leaves as fresh as possible. Before a month has passed those leaves, finding insufficient nourishment, will begin to wither and will eventually die off, spoiling the look of the batch for some little time. But after they are gone a movement can be seen in the crown which begins to become prominent, and this is a telegraphic sign that the roots are beginning to come. We know then that all is well, and if we continue the same treatment a pair of large new leaves will form about November and the welfare of the plant is assured.

No attempt must be made to force these young plants—they cannot stand it, for their root system is but slowly developing—but allow them to come along at their own pace, feeding them as the small supply of soil in which they are becomes exhausted; quite a large percentage will show bloom, and not only show it, but develop it and perfect it. Those which do not bloom should be potted into 48's during the spring and encouraged to grow healthily, so that by August they will in turn have developed their crowns with a certainty of producing large heads in the following spring. Such plants as these will stand a little gentle forcing and be in the market a month before the cuttings. There is a great demand for such plants.

Marguerites

The demand for both the single and double forms of the Marguerite is always heavy. There is scarcely a garden in the country for which it is not required, so that the nurseryman is bound to raise considerable numbers if he is to supply his customers. Presumably a great many nurserymen do not find it convenient to winter it, for during March and April "the trade" clamours for it and buys in at from 8s. to 10s. per 100.

The essential conditions for its successful cultivation in a young state are coolness and moisture, combined with a soil sympathetic with both and of an open, springy nature to encourage an extra vigorous root. Grown healthily under these conditions, it is able to withstand the attacks of its most

formidable enemy, the leaf-mining maggot, a pest capable of destroying any number of plants among which it can obtain a foothold.

Cuttings should be taken from plants in the open about the middle of September and continuously till frost puts a stop to it, generally towards the end of October. Probably the best time is at Michaelmas. A well-grown plant will often furnish fully 100 cuttings, and these should be made exactly as we recommended for Calceolarias.

In the extreme South of England they may be inserted and wintered in cold frames, but over the greater part of the country the frosts are usually too severe to permit this economical method of raising them and we are compelled to use boxes or pans so that in the event of severe weather coming they may readily be removed from the cold frame to the cool house for safety.

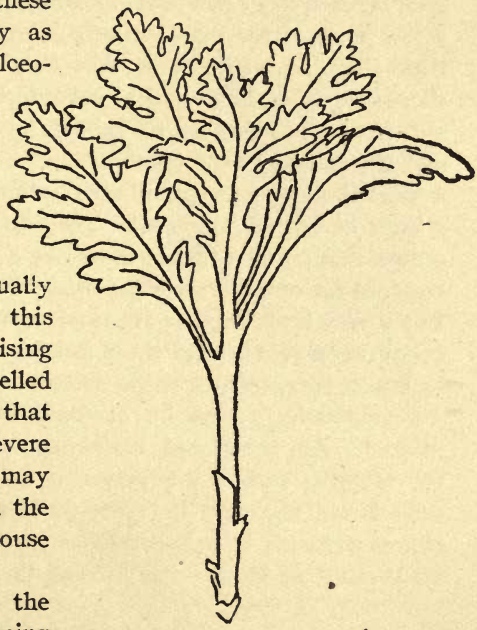

FIG. 10.—Cutting of Marguerite

The young tops of all the current growth (not being flowering wood) make splendid cuttings, and these are obtained not only from the leaders, but from the numerous side growths this plant invariably throws out. Hard wood does not readily root; indeed, we have noticed that cuttings made of hardened growths refuse to root even though they may put on a limited growth.

An open, fine, and sandy soil, which readily dries out, is not a suitable medium to strike the cuttings in; they require a soil, as suggested above, retentive of moisture and of a cool nature, a compost made up of principally sifted pasture loam, leaf mould,

and sand. They must be firmly embedded in this soil, a blunt dibble being a useful tool to press it well around their base. In about a month they will begin to root if they have received attention in the way of sprinkling and shading, and their rooting can readily be detected by the jaunty manner in which they erect their foliage and assert their independence as plants.

Marguerites are free-rooting plants and the young cuttings soon become congested in the boxes or pans, and if this continues a few more of the vigorous will deprive the weaker portion of their share of nutrition so that they remain dormant. They should therefore be potted as early in the season as convenient, say, from mid-February till mid-March, 3½-inch pots being used and the compost very much as that used for the cuttings, plus a modicum of manure. The treatment must still be—must always be—moist and cool. They will require pinching when grown about 3 or 4 inches to induce a bushy growth, and those required for ordinary bedding sales will need no further potting. But a very large number are required for window boxes and pot or specimen plants, and these must be potted on early in April to 5-inch pots, using a more generous compost.

Overcrowding must be avoided, and they must never be starved. An occasional sprinkling with soot-water prevents the maggot, and as prevention is infinitely better than cure, this should regularly be done at least once a week. At the risk of irritating by reiteration we repeat that the two things to be avoided in Marguerite growing is dryness and undue heat.

Lobelias

The Lobelia may very safely be propagated by the thousand. We almost question whether it is profitable to propagate in smaller quantities. It occupies but little space throughout the winter and is so superior in every respect to those raised from seeds, that those who have facilities might well be persuaded to take it up. It never requires a great heat, neither does it like to dry out; a moist, temperate atmosphere being what it really enjoys. To obtain cuttings in quantity stock plants must be cut down at the end of August to induce young growths of a non-flowering character to spring up very much like what

we need in a Viola, only much smaller. At the end of September and early in October these plants should be lifted and the cuttings taken off—or it may be, if the weather has been moist, a large proportion of them will already be rooted so that it becomes partly a matter of division and partly of cuttings. It is, of course, an advantage to take cuttings ready rooted, but we cannot always have that, and when cuttings have to be made every growth upward of ½ inch long may become a cutting. It needs little making, probably only the removal of a leaf or two, and when made should be dibbled into sandy soil at less than an inch apart. We generally use round or square pans or, failing those, 6-inch pots. Kept close and moist, they root in a week and at once begin to grow until they completely cover the pots or pans. About Christmas time we go over these with a knife and take off probably half of each plant, which we treat as we treated their parents, and so on through the early spring months, till from every thousand of the original cuttings we have supplied ourselves with ten thousand. The soil used is calculated to hold moisture, so is neither very fine nor sandy, but a surface of silver sand is provided partly to induce the surface roots and partly to guard against "damping off." In early spring they are boxed, and so marketed.

Regal and Show Pelargoniums

This class of Pelargonium furnishes typical market plants, and though they are not so popular as they were a generation ago they still command a considerable following. There are few villages throughout England where cottage windows are not ablaze with their bloom till the early autumn, and fewer conservatories that do not owe a portion of their summer beauty to their many-shaded and abundant blossoms.

The growing of the show Pelargonium used to be a regular cult, much as that of the Chrysanthemum became, but it was a generation old when the 'mum first appeared upon the scene. Several of the leading nurseries specialised in it and built up huge specimens that were marvels of skill and great masses of colour. But it was most popular as a market plant in a 5-inch

pot, and a plant which satisfies in that standard is the plant that is going to live.

Closely allied as this plant is to the Zonal, its treatment has to be totally different. For example, we do not make its cuttings in spring and autumn, but in the height of summer. We do not make them from terminal growths, but from the hard well-ripened wood. Compare this sketch with that of the tricolour Geranium cutting. (See Fig. 11.)

The Pelargonium suffers under one disadvantage when compared with the Zonal in that it is not a continuous flowerer. Its season of bloom scarcely extends over two months, when the plant, having exhausted itself by its marvellous floriferousness, demands a season of rest. We begin to reduce the amount of water given; the leaves, if healthy, turn yellow and fall off, and when that process is complete the history of the next generation begins, for, taking the ripened plant in hand, we cut the current year's wood to within ½ inch of the old and make cuttings of it; 48-size pots are carefully crocked and filled with sandy soil well firmed, then around the edge of the pot we insert eight of these cuttings, letting them well in, firming them, and only allowing about ¼ inch appear above soil. We immerse them in a pail of water and then stand the pots well in the open exposed to every ray of sunshine of the long summer days. This gives the key to the whole of their cultivation—viz., that they must be dealt with hardly and without the slightest attempt to "coddle."

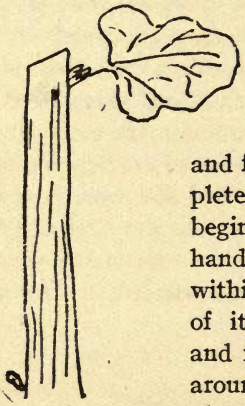

FIG. 11.—Cutting of Regal Pelargonium

Throughout August the cuttings receive a daily sprinkling, are kept free from weeds, but otherwise left to themselves. By September they are rooted and emitting leaves, and then quite early they are potted up into small 60's and given the advantage of a cold frame, so that for a very few days they may be shaded if necessary. The soil they are in is not rich, but consists of two parts loam to one of leaf soil and some coarse sand.

By the middle of October they will be found to be well established and growing freely, and, pinching off their tips, they must then be taken indoors and housed in the lightest, airiest, and coolest part—say, on a stage not far removed from the glass.

When they are ready for potting on, which will be in a week or two, mix a generous compost made up of two parts fibrous loam, chopped, one part old cow manure, chopped, one part leaf soil, sifted, and an addition of coarse sand and mortar rubble. Use 48's as far as possible, for this is *the* market size. Pot very firmly, as that is most conducive to short, sturdy growth. Do not overwater—that is, water carefully and tentatively until the pots are full of roots and growth is very active, from which stage onward they must never get dried out.

The plants will probably put out more growths than can be carried on, and it is well to rub off the superfluous ones as soon as they can be seen. Leave no more than three shoots and keep these pinched back so that each of the three becomes a system of breaks in itself. Do not again stop them after April, but feed well three times a week with liquid manure, the safest and best being obtained from the water butt in which a bag of cow manure is immersed.

Plenty of light, abundance of air, space, and little heat are the essentials in producing good marketable Pelargoniums, and if these rules of health are scrupulously attended to there is little to fear from the green fly, which is so powerfully attracted to any plant which is the least bit " off colour." Always be on the look-out for them, and do not neglect such a preventive measure as occasional fumigation.

Pansies and Violas

For the purposes of this work the Pansy and Viola may be regarded as almost identical. The latter has the greater vogue and is more generally propagated from cuttings, because the named varieties are so universally used for bedding purposes. It is only as cuttings that they come under glass cultivation, and even then they require no heat and but little protection. There are more Violas lost through East winds in the spring than

by the severest frosts of winter. Though there are a great number of varieties those mostly grown would not much exceed two dozen, though fanciers could easily reel off the names of three times as many. For all practical purposes a nurseryman, unless he is a Viola specialist, will limit himself to the smaller number, choosing rather to grow large stocks of a few leading varieties than a small stock of many.

In taking cuttings of Pansies and Violas, those young growths arising from the base of the plants should be chosen. The larger top growths are purely and simply flowering growths, being hollow and incapable of originating roots. (See Fig. 12.)

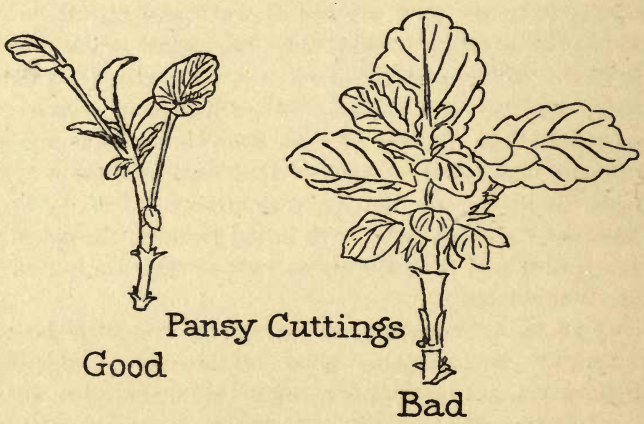

FIG. 12.

Make them about 2 inches in length—shorter if necessary rather than longer—cutting close below a joint and trimming away a pair or two of leaves. Insert about 1 inch apart with 3 inches from row to row, giving the usual close treatment in partial shade till rooted. The bed should be as advised for Arabis.

PENTSTEMONS

This is another subject which requires the protection of glass during its incipient stages only. It is a plant with a great future before it, therefore one to be noted. The cuttings should be taken from mid-September till mid-October and put in exactly

as advised for Calceolarias. As a rule cuttings are plentiful, the tips of the growths being used, cut 2 or 3 inches in length, and always immediately below a joint. If a cold frame is available and the rooted cuttings can remain until planting out time in April, they should be at least 2 inches apart in the rows, or even 3 inches, but if boxes or pans are used and stood in cold houses, then they may be closer together, for in all probability it would be found necessary to transplant or pot them off in March. A fair proportion of the cuttings emit roots within six weeks, but a certain proportion, probably one-third, do not root until February. Winter treatment should aim at keeping them moist without being wet, ventilating them after sprinkling until the time when they begin to make growth. From then onward they will need more copious waterings, but always on a well-drained soil.

Salvia Patens

There are very few blue flowers that can compare with the beautiful blue S. Patens, hence its popularity.

In autumn the plants are taken up and cut down, the tubers or long, fleshy roots being stored where dryness and warmth can be afforded them. They are very tender, and very little frost will kill them outright. In March they are fetched out of store, cleaned and trimmed, and potted into 48's. If space is an important consideration, then they can be boxed, but we find better results from the potted plants. Give warm, moist treatment, and as the young growths are thrown up take them off low down as cuttings and insert them around the edges of pots, using a porous soil with ½ inch coarse silver sand on the surface. Keep them in the propagating case till rooted, when they can be taken out and potted into 60's, still being kept warm. In April transfer them to a cooler house to harden off.

Salvia Pride of Zurich

This in every respect differs widely from S. Patens. Colour, habit, root system, all are as different as possible. Salvias of the Zurich type serve a multitude of purposes. They make admirable and showy pot plants for early summer as well as for the

late autumn. They are used in all kinds of decorative and colour schemes—are often used where scarlet Geraniums could be used and by many people are preferred as being more floriferous and less coarse. A nurseryman who has the facilities for growing a few thousands of these may feel fairly complacent as to selling them, the trade itself being always the heaviest buyer.

Cuttings make dwarfer and earlier blooming plants than seedlings, but the latter have the finer blooms. Some prefer the one, some prefer the other, but on the whole the trade plump for cuttings.

Some growers experience difficulty in preserving their stock plants through the winter, and we venture to express the opinion that perhaps they give them too much attention. Most of the Sages like conditions that we may describe as warm and dry, but they do not like to be stood just over the hot-water pipes where copious and frequent waterings are necessary to life. They neither ask for a fierce heat nor a desert-like aridity, but for a temperature ranging from 55° to 60° F., and just sufficient water to keep them alive. But all the difficulties of the winter may be avoided by putting in a sufficient batch of cuttings early in September, wintering them in stores on the shelves, and potting off in February—the young tops of these will furnish further cuttings in April.

Let us, however, revert to the old plants. By February the old soil in the pots is dried out—useless, and we cannot look for healthy cuttings to grow from such a source, so we prune the plants back, give them water, and directly we see them becoming active we shake all the old soil from the roots and re-pot into new, standing them in a warm spot. Growth is fairly rapid and each plant yields a continuous supply of cuttings for some time. These, if inserted either in a sandy prepared bed or in pots or pans, will soon root, when they are potted straight into 60's and grown on in warmth, being hardened off in frames during May. The best plants should be selected and grown on in 48's, as that size is needed for many purposes. The demand is constant and the difference in the value of bedding stuff and 48 stuff is so marked that we have often wished our whole stock had been grown to the larger size.

There is no secret in their cultivation. Keep them in a growing atmosphere, syringe them daily and bear in mind that the white tomato fly appears to be as fond of the Salvia as of the Tomato.

VERBENAS

Having suffered a temporary eclipse, there is, we feel confident, a time of resuscitation for this erstwhile popular flower. Its blooms are too brilliant and vivid to be permitted to lag in the background, and though no one can expect it to assume its old importance as a bedding plant all at once, there can be no doubt that, well grown, it will prove an acceptable market plant. Its one weakness is seen in its susceptibility to attacks from mildew, but this can be greatly obviated by correct treatment.

When the Verbena was at the height of its popularity some decades ago, there was a large nursery firm in Wiltshire that made it one of their specialities, and as their output was very many thousands every year they had their own way of producing them. Strong heat, abundant moisture, and silver sand used as they used them caused cuttings to root in two or three days. Taking ordinary nursery saucers, they filled them with silver sand, then immersing the filled saucer in a pail of water until it was fully charged, they took the young Verbena shoots and made a cutting of every pair of leaves. Taking this cutting with the finger and thumb they simply pushed it into the water-charged sand, about a score to the 4½-inch saucer. Half the foliage was below the surface. The water was replenished every day, so that literally the cuttings rooted in water, the sand being merely a medium for holding them in position. This, of course, involved the potting off of all the cuttings within a week of insertion, otherwise the water in itself could not afford sufficient sustenance. The propagating pit in which they were stood had a bottom heat of 75° to 80°, and the whole thing was intensive and express. For some days after they were potted into 72's they were subjected to close treatment in the same house, and not until they had started growing and been pinched back were they taken to a cooler house.

After its earliest stage the Verbena must have treatment which is cool and moist, for it is when it meets with a dry, hot

regime that it so readily succumbs to mildew. A little flowers of sulphur should always be near to the hand of the Verbena grower.

Greenhouse Climbers

Greenhouse Climbers embrace a considerable variety of subjects, the greater part of which respond to identical treatment. Most of them are propagated from cuttings, some few from seeds, the demand for them being consistently steady. It is sometimes difficult to draw the line between greenhouse and hardy Climbers, some of the former thriving in the open air down south and some of the latter finding frequent use in greenhouses, especially farther north. But we should rule the following representative plants as belonging to the different sections :—

Hardy Climbers.	Greenhouse Climbers.
Ampelopsis.	Abutilons.
Aristolochias.	Cobeas.
Bignonias.	Eccremocarpus.
Clematis.	Habrothamnus.
Honeysuckles.	Hoyas.
Ivies.	Tacsonias.
Jasmines.	Plumbagos.
Passifloras.	Pereskia.
Polygonums.	
Wistarias.	

We leave out such stove climbers as Allamandas, Clerodendrons, Gloriosas, Stephanotis, etc., because the trade in these cannot be called a market trade, being done entirely retail by the general nurserymen. We therefore confine our remarks to legitimate greenhouse climbers.

Eccremocarpus Scaber and Plumbago Capensis are easily raised from seeds, and where seedlings are as reliable as cuttings and give less trouble, we give the preference to them. When we want Cobea Scandens we resort to seeds, but for Cobea S. Variegata we must perforce fall back on cuttings. Hoyas, Habrothamnus, Abutilons, Tacsonias, and Pereskias are all grown from cuttings, the latter being grown chiefly as a stock for Epiphyllums. Perhaps we ought to include the Passion Flowers here, as it is more often grown through all its earlier stages in the greenhouse.

The variegated Cobea is probably the most difficult of all the group to propagate. It needs the treatment of the propagating pit and should be struck in April and May. All the remainder will respond to more Spartan conditions and may be made either in the spring or in the autumn. Shade, moisture, and warmth are as necessary to them as to nearly all cuttings, but, given these, no other difficulties are likely to intervene. When struck, pot and grow on in the greenhouse.

CHAPTER VI.

POTTING

Again and again we have had to refer to the potting of plants which, we might venture to say, is the principal and ever-recurring work in the glasshouses of a general nursery.

To the man of experience potting is a simple, clean, precise, and methodical operation, and is as simple as it looks; but to the fumbling fingers of the tyro it seems most formidable. So precise is it that it becomes mechanical, so much so that when the experienced potter stands up to his bench to pot a batch of 10,000 plants it may be taken for granted that every one of that 10,000 is subjected to the same manipulation in every detail—the same pressure, the same handling, the same twists and turns the same movements throughout.

Such method of handling conduces to rapidity of movement, and we have known plantsmen who were old-fashioned enough to take such interest in their work that they found great enjoyment in standing at the bench ten hours a day and rattling off 600 per hour consistently. They were, of course, kept well fed with plants and pots, and these were carried away as they left the potter's hands. But we will not yet consider matters relating to speed, and will get back to the fundamentals.

There are certain principles essential to good potting upon which we are adamant. They are :—

(1) The pots must be scrupulously clean and should, if not new, be washed in preference to being merely rubbed out.
(2) They must be bone dry when they are used.
(3) If they are larger than ordinary 60's, efficient drainage must be provided for by sherds.

We use the imperative "must" advisedly, because there is really no choice in the matter if the future welfare of the plants has to be considered first. And why do we insist upon them? Let us see.

(1) *Cleanliness.*—We have no desire to make ourselves objectionable by frequent repetitions, and though we had something to say on this subject before (see page 6) we purposely omitted there what we want to say here.

If any particles of old soil adhere to the pot on the inside, those particles will not become incorporated with the new soil, but remain for all practical purposes as parts of the pot. The new roots will fasten upon them, and should you want to turn the plant out to inspect the roots or for the purpose of re-potting, those roots will break off. Further, such adhesive soil interferes very badly with the perfect action of the drainage system, an essential feature of which is the unobstructed passage of water between the soil and the pot. It can thus be seen that cleanliness is not merely sentiment, but that it has practical and positive results.

(2) *Dry Pots.*—If the pot is wet when used it is impossible to make satisfactory work. In the first place, many crumbs or particles of the soil at once adhere to the side of the pots and produce those very conditions to which we have just referred. The main body of the soil, absorbing most of the moisture like blotting paper, would, in drying, shrink from the pot and contract exactly as would be the case if the soil itself were too wet. The ill effects of these are too palpable to call for further comment.

(3) *Drainage.*—The drainage provided for a pot varies according to its size and the uses to which it is going to be put, but there is only the one principle involved. For a 3-inch or 4-inch pot a single sherd, concave over the hole and nearly covering the bottom of the pot, suffices. A 5-inch pot calls for the large concave sherd over the hole with the addition of a few smaller ones. A 7-inch pot needs a large sherd and about ½ inch of smaller ones, while a 9-inch pot requires 1 inch of small placed over the large. This is approximate, and if the plants to be potted call for no special drainage. A 6-inch pot prepared for ordinary cuttings should be one-third full of crocks, and there are some plants, chiefly among orchids, for which we not only

half fill the pot with crocks, but also mix a few small ones with the compost. All this is to show that the crocking of a pot is somewhat important and should be done correctly. The health of the plant depends very largely upon the drainage provided, for it keeps the roots warm and healthy and the soil sweet and wholesome. Simple though the matter is it is based strictly on science, and if we fail to look upon it as such, we are apt to miss its full significance.

The Soil.

Having now agreed about the pots we will pass on to consider the soil, and obviously we have here a very potent factor. Composts vary according to the needs of the plants for which they are intended, and their preparation is decided by the responsible man on the spot. Though we are therefore unable to lay down any specific rules concerning the constituents of a compost, we can, with some advantage, make a few remarks concerning the basic soils from which they are made up.

Throughout previous chapters we have many times referred to them when advising on soils, but it may be well now that we are dealing with the subject specifically to classify them. They are :—

1. Peat.
2. Loam.
3. Leaf Mould.
4. Rotted Manure.
5. Sand.

Of these *Peat* is the only one which for certain plants may be considered a complete soil. There are certain bog plants needing no other admixture, and Rhododendrons and Azaleas and a few stove plants. There are varying qualities in Peat owing, we opine, to differences in age. A really good black peat with but a small admixture of silica in it, full of fibre, is the peat we prefer and which we have in mind whenever we allude to it.

Loam is the most potent of all our soils, though too heavy of itself for using in pots. As with peat, so with loam—it may be had in varying qualities. What we call " top-spit " from an old pasture is the ideal, and it is full of the fibrous roots of the

turf. Loam which falls apart when hit with a spade is not our kind of loam, and we prefer it to need plenty of chopping and if need be pulling to pieces by hand. Not dry and brittle, but fat and adhesive. Speaking generally, it is the groundwork of most of our composts, modified in varying degrees by proportions of the other soils. It is the heaviest of our soils.

Leaf Mould.—Leaves of the oak, the beech, and Spanish chestnut, etc., collected and laid in a great heap for two or three years produce good rich leaf mould. Too light and too inconsistent to use alone, it imparts friability to loam, to say nothing now of its chemical value. Because of its extreme lightness it ought to be thoroughly decayed before being considered fit for use, and to avoid flakiness ought to be rubbed through a ¼-inch sieve. It is never permitted to preponderate in any compost, indeed the proportion should always be below one-half, or even as low as one-fourth, this, however, depending upon the kind of plants it has to be used for. As a natural plant food it has a high value, and as a mechanical agent determining the textural quality of the compost it has an equally high value.

Manure.—Well-rotted stable manure approximates very nearly to the leaf mould in texture, but is too rich to be its substitute. It has to be used very sparingly indeed for young stock, and with discriminating judgment at all times. Manure from the cow byre is its strongest form, used for strong constitutioned and gross feeding plants such as the Chrysanthemum. This is a heavy manure and cannot be used freely or for as many purposes as the more innocuous stable manure. For small pots it is advisable to pass all manures through a sieve, but for 5-inch pots and upwards we prefer not only the manure but all other soils, save and except leaf mould, chopped up with a spade. Except for seed sowing, we have a decided antipathy to fine soil.

Sand.—The sand we have in mind is clean silver sand. It must be coarse, as its one object is to open the soil. There is no feeding value in it, its effect being purely mechanical. But though its functions are so limited, nothing can detract from its importance. It assists the drainage, promotes the aeration of the soil, admits the heat, opens the way for the roots so that they can percolate more freely throughout the soil, helps to keep it

sweet, and in short is a most indispensable subject. Nothing can answer the same purpose. Fine yellow sand which we sometimes see used for cheapness is no substitute, for rather than opening the soil it binds it together. Fine silver sand, being harder, will not do that, but it cannot open the soil like to the coarser.

It has a further use with regard to cuttings, for it helps to prevent damping off, and it is also an aid to the young roots. We worked under an instructor many years ago who covered his cutting pots with really dry silver sand, so that as he removed his dibble from the hole and simultaneously inserted the cutting, the silver sand ran in too and simply embedded that cutting in sand. Beyond any shadow of doubt he was acting on a correct principle.

Potting Young Plants

We now come to the actual potting, and will deal first with the handling of rooted cuttings and seedlings.

There is no stereotyped way of potting these, but there is room for plenty of individuality. Every potter develops a method of his own, and though differing from one another in small matters of detail they all strictly adhere to the points that matter. These are :—

(1) That the roots are not cramped or doubled up.
(2) That they do not reach out to the side of the pot.
(3) That they are not buried too deeply.
(4) That the soil is uniformly firm from the top of the pot to the bottom.
(5) That the degree of firmness is decided by the known requirements of the class of plants being potted.
(6) That the pots are not too full.

We have said that in matters of detail every potter is a law unto himself, so in describing how to do it we will fall back upon our own method. Given a large number of rooted cuttings or seedlings with small roots, we will describe as nearly as we may our own method of handling.

The size pot we are dealing with is what is known as small 60's. On the bench immediately before us is a heap of compost

on which the young plants lie. Convenient to our hand is the heap of pots. We reach the pot forward with the left hand and some soil with the right, and immediately the pot is in position before us the soil is dropped in, practically simultaneously, followed by the fingers of the right hand which presses the soil towards one side of the pot to half its depth. That completes the first movement.

Next, the left hand takes up a plant at the same moment that the right hand takes up soil, sufficient to fill the pot. The plant being placed, the soil is dropped over the roots, while the thumb and index finger of the left hand and the thumb of the right, encircling the stem of the plant, press the soil firmly down to its roots. This completes the second movement.

Next, the pot is gripped in this fashion: the index fingers embracing the pot on the far side, the bent middle fingers embracing the near side, and the two thumbs pressing on the soil. One smart rap, accompanied by thumb pressure, a sharp half turn of the pot, then another rap and pressure, and the operation is practically complete, except that as the left hand removes the potted plant and brings back another pot, a sweep of the right hand on its way for soil clears away any crumbs which may be in the way of the succeeding pot. Thus there is always the clean hard bench to rap the pot on.

This takes some time in the telling and it is difficult to describe the movements with that clarity we would like, but there are other minute details quite indescribable which stamp the individuality of the potter. These will only be detected and acquired by practice. To disabuse any mind which considers these movements at all complicated we can only say that as each movement is practically simultaneous, it is simple and rapid enough to enable us throughout a long day to pot from 500 to 600 per hour, or about ten per minute. When we come to describe the potting of established plants into large pots, the practice is of a more stereotyped character, and practically all plantsmen do it in the same way. Individuality counts for little in the necessary movements, but we think it does count in the efficiency and thoroughness of the work.

We will take the re-potting of a Dracœna from a 48 to a 24

as our example. We shall need a potting stick, otherwise a small rammer, with which to press the soil home, and this is made from a smooth stick about 1 inch in diameter, with the sides slightly flattened and about a foot in length. The pot being well crocked, we take a good handful of the coarsest of our compost and with the stick we ram this firmly. Next, we turn the plant which is to be potted out of the 48, break away the crocks, round off the top edges, liberate the lower roots which are usually in a coil, then standing it on the firm bottom we hold it in position while with the right hand we partly fill in with compost. Then holding the foliage in a left-hand grip, we take the rammer and run it down inside the pot, making the compost as firm as we think it advisable, then, filling in more compost, keep firming till the pot is filled to within an inch of the top. It is important to see that the same degree of firmness runs through the whole pot, and this is more difficult to guarantee if sufficient compost is put on at once to fill the pot; safer and better is it to fill up at twice.

Watering Newly-Potted Plants

It is a disputed point whether it is better to give newly-potted plants one good watering to settle the soil and afterwards sprinkle lightly each day until root growth begins, or to omit the heavy watering altogether. We have tried both ways with equal success, though probably the latter is the safer. In practice it works out with us that during the winter half—October-March—we omit the soaking, but from March onward we find it best to give it. Be that as it may, the watering of newly-potted plants must be done carefully. There is no activity in the roots to absorb any of the moisture, practically the soil is inert, and if it becomes too wet it cannot function properly. On the other hand, extreme dryness must be avoided or the plants badly flag and have no reserve of energy left to help themselves to recover.

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